ELECTRICAL REVIEW

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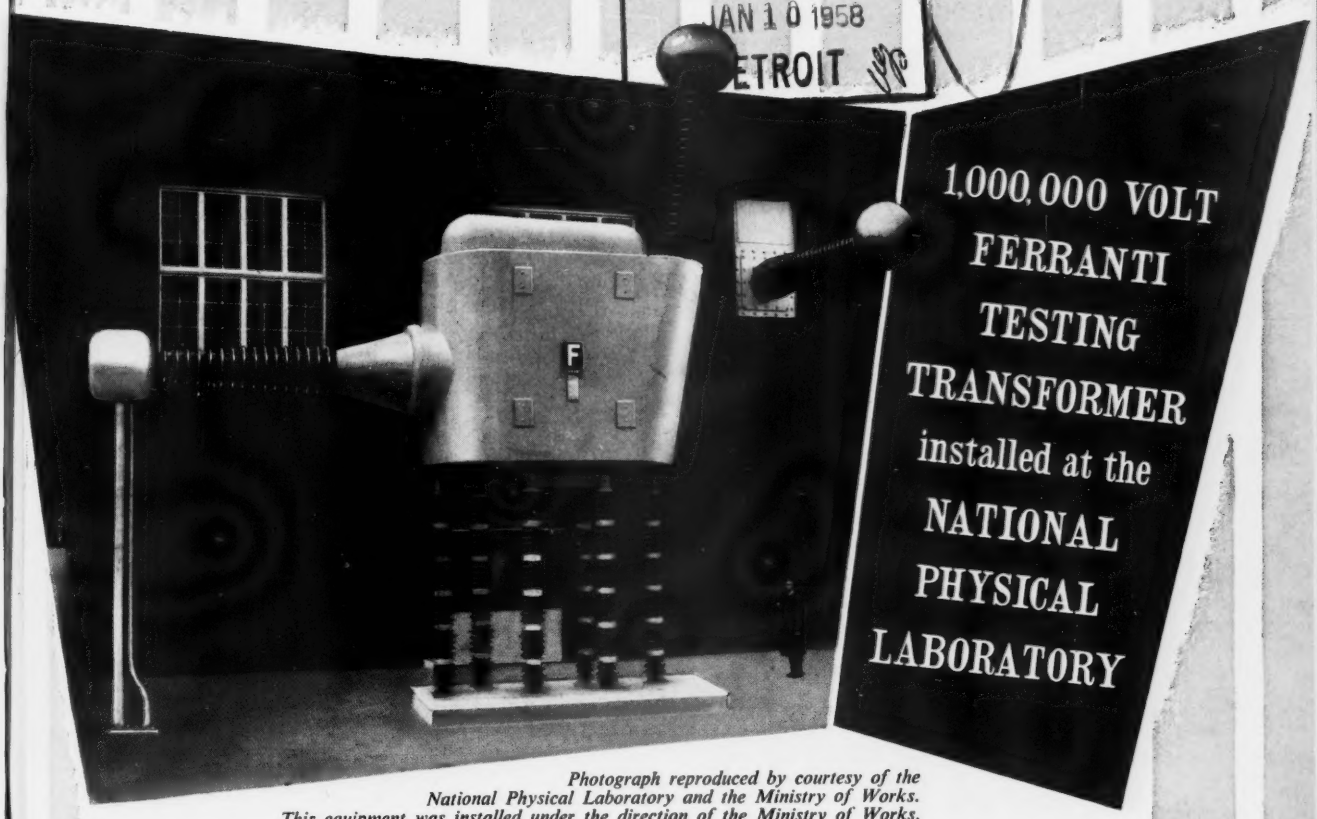
ETROIT



Photograph reproduced by courtesy of the National Physical Laboratory and the Ministry of Works. This equipment was installed under the direction of the Ministry of Works.

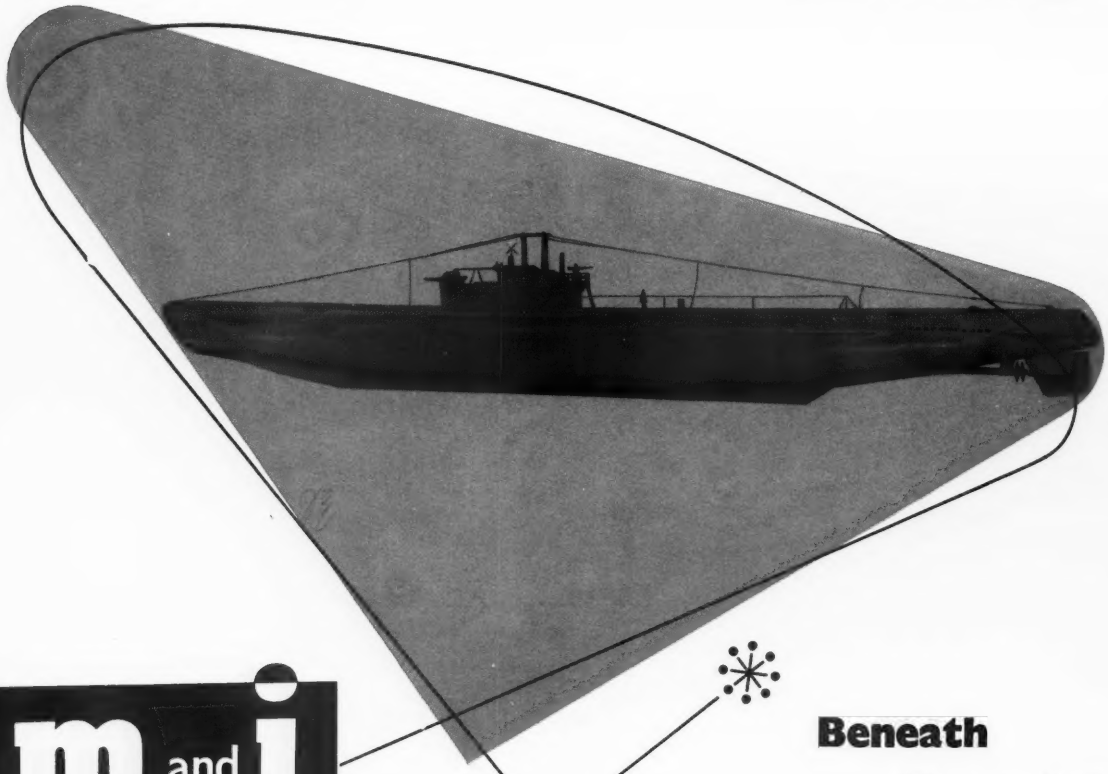
The highest voltage outdoor testing transformer in the United Kingdom

A 1,000,000 Volt Ferranti Testing Transformer operating with the tank at a potential of 500,000 Volts above earth. The transformer is mounted on 6 columns of insulators at a height of 12 feet from ground level. The overall height of the complete equipment is 36 feet. Associated with the equipment is a 1,000,000 Volt wall bushing, 36 feet in length, through which the supply is carried to the test laboratories. Ferranti are specialists in the manufacture of High Voltage A.C., D.C. and Impulse Testing Equipments for all kinds of research and routine testing and are backed by over 70 years' experience in the manufacture and development of electrical apparatus.

F FERRANTI

FERRANTI LTD HOLLINWOOD · LANCS

London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

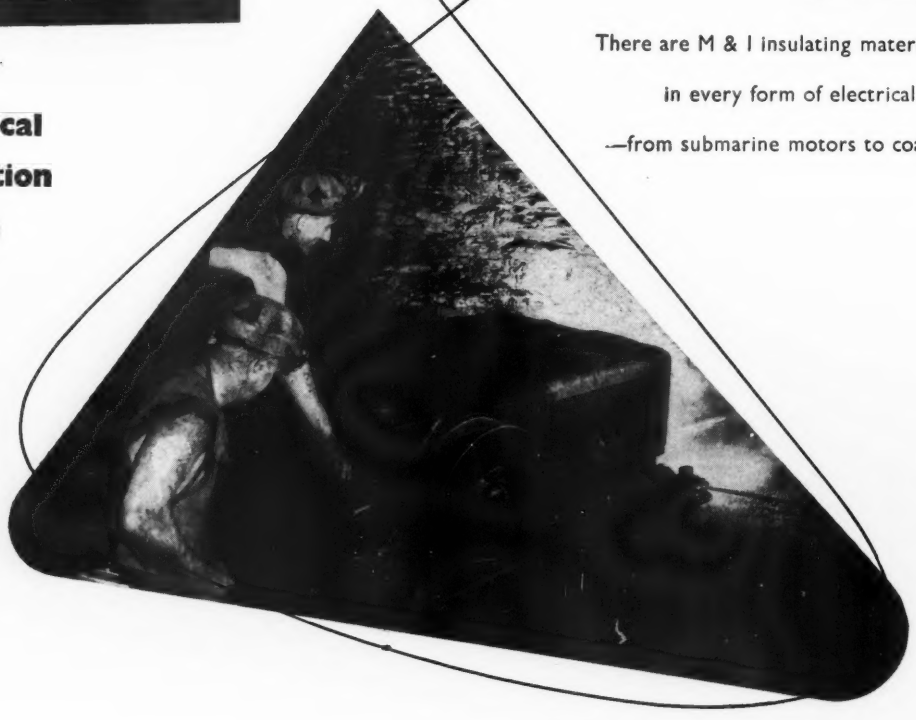


m and i

the electrical insulation people

Beneath the surface

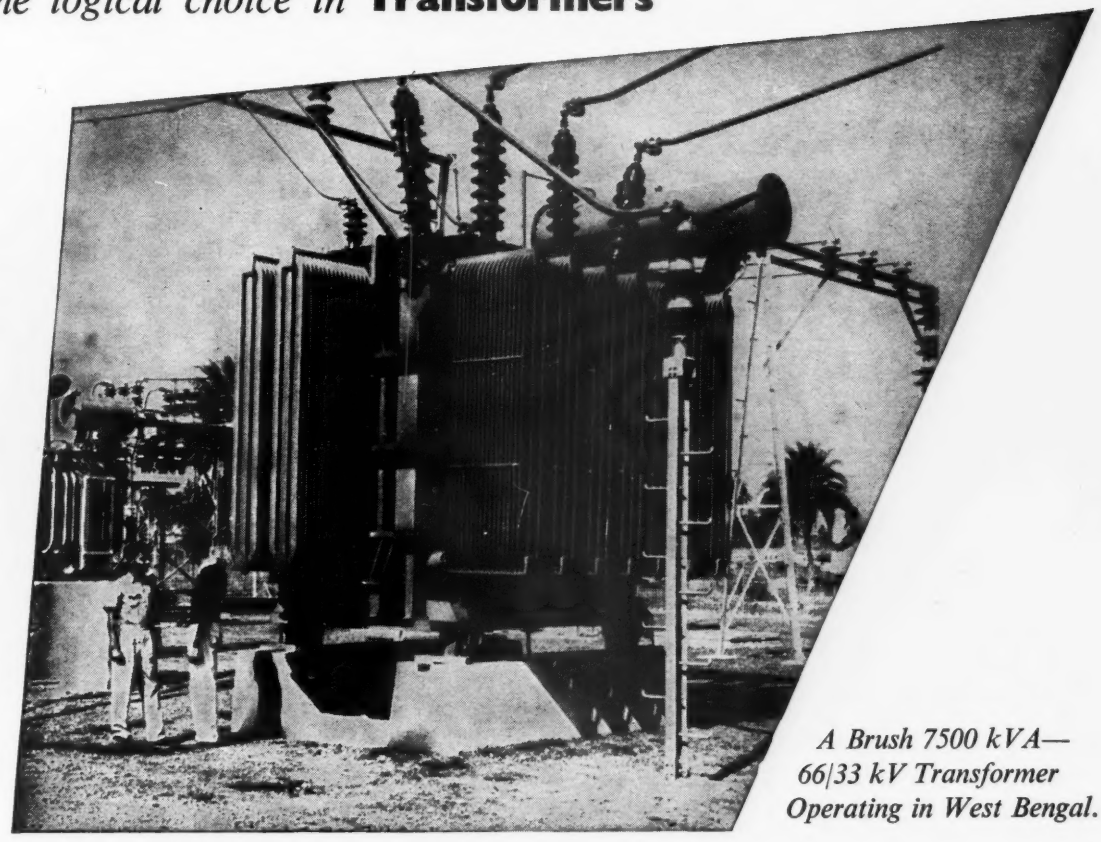
There are M & I insulating materials in every form of electrical equipment —from submarine motors to coal cutters.



TOP PHOTOGRAPH by courtesy of The Admiralty and Vickers-Armstrongs Ltd.
LOWER PHOTOGRAPH by courtesy of The National Coal Board.

THE MICANITE & INSULATORS CO., LTD., WALTHAMSTOW, LONDON, E.17.
TELEPHONE: LARKSWOOD 5500. TELEGRAMS: "MYTILITE", EASPHONE, LONDON.

The logical choice in **Transformers**



A Brush 7500 kVA—
66/33 kV Transformer
Operating in West Bengal.

At home and abroad, Brush Transformers stand as a striking testimony to the thoroughness with which they are built to give long service under extreme climatic conditions. For power and distribution purposes, Brush Transformers are built in sizes up to 45 MVA and 132 kV.

BRUSH — ***for quality***

AVAILABLE FROM STOCK
Brush T1 Transformers from 50 kVA to 1000 kVA built strictly in accordance with British Electricity Specification T1 (1954).

Full details of the Units available on application to Department S.H.5.

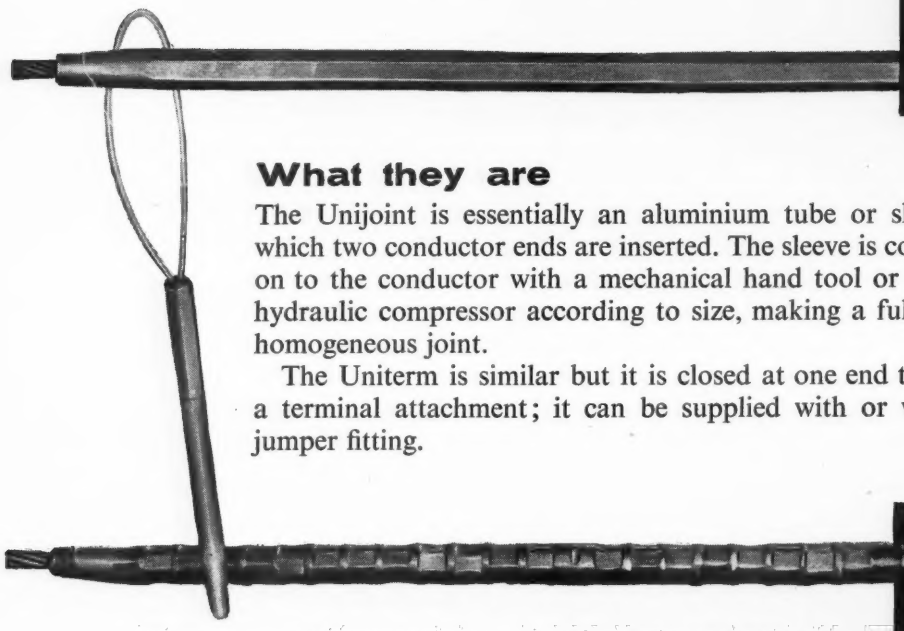
BRUSH ELECTRICAL ENGINEERING CO · LTD

Loughborough · England · (Member of the Brush Group)

Z.1.

A

UNIJOINT
and
UNITERM
new high-efficiency conductor accessories



What they are

The Unijoint is essentially an aluminium tube or sleeve into which two conductor ends are inserted. The sleeve is compressed on to the conductor with a mechanical hand tool or a ten-ton hydraulic compressor according to size, making a full-strength homogeneous joint.

The Uniterm is similar but it is closed at one end to provide a terminal attachment; it can be supplied with or without a jumper fitting.

These new, compact, lightweight fittings offer the following advantages:—

1 They can be used with small sizes (up to 0.6 in. diameter) of steel-cored aluminium, aluminium alloy, and all-aluminium conductors in standard strandings, including smooth-body.

2 They are inexpensive, easy to handle and quick to apply.

3 They have high gripping force (guaranteed 95% of conductor strength), thanks to the special high-friction compound used. This permits small sizes of S.C.A. conductor to be joined without the use of a separate compression joint on the steel core wire.

4 They have been comprehensively tested, mechanically and electrically, including heat-cycle tests.

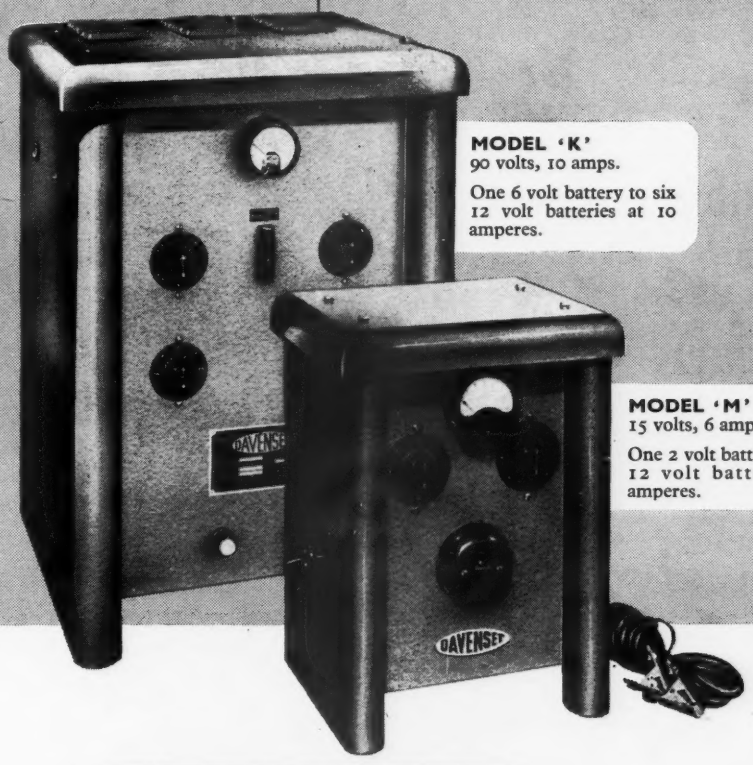
5 They are supplied prefilled with the special compound and capped at both ends.

6 They can be compressed either by means of a ten-ton hydraulic compressor or, in the smaller sizes, with a modified bolt cropper.

ALL Noral compression accessories have been redesigned for lower costs, lighter weight and all are readily available. If you would like to know more about Noral compression accessories, which are backed by service experience in all parts of the world and by extensive research facilities, please get in touch with our Sales Development Division, Banbury, Oxon.

Northern Aluminium

An ALUMINIUM LIMITED Company Northern Aluminium Company Limited, Bush House, Aldwych, London, W.C.2



MODEL 'K'
90 volts, 10 amps.

One 6 volt battery to six 12 volt batteries at 10 amperes.

MODEL 'M'
15 volts, 6 amps.

One 2 volt battery to one 12 volt battery at 6 amperes.

DAVENSET

Commercial Chargers of all types

PARTRIDGE WILSON & CO. LTD.
DAVENSET ELECTRICAL WORKS, LEICESTER

MODEL 'DSC2'
75 volts, 6 amps. and 10 amps.

One 6 volt to five 12 volt batteries on each circuit.

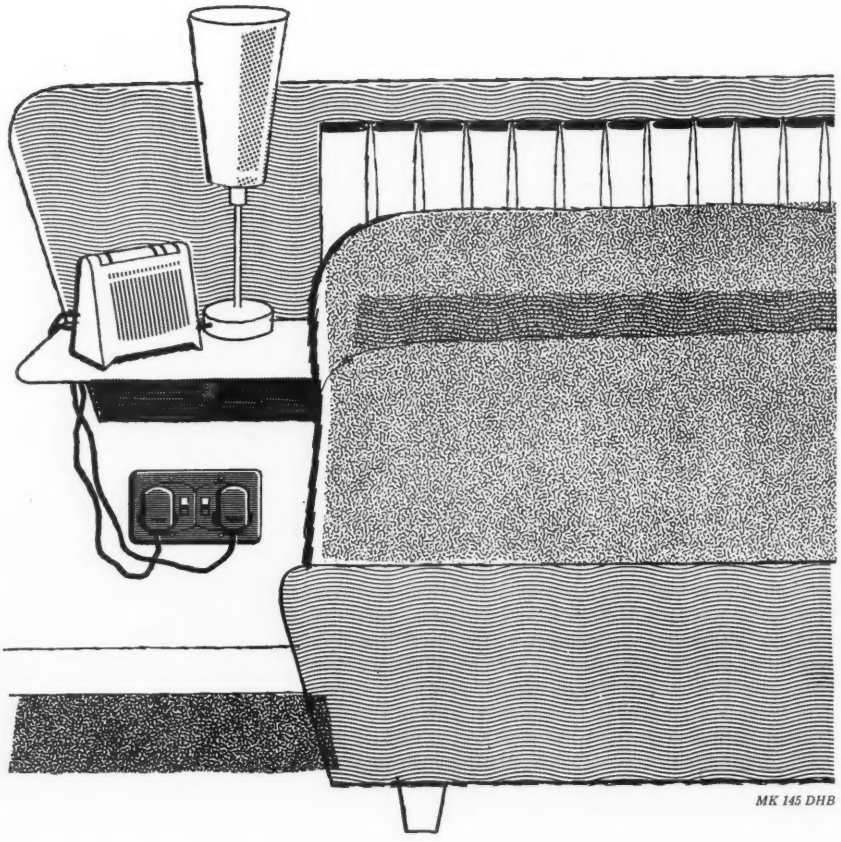
MODEL 'T'
30 volts, 3 amps. and 6 amps.

One 6 volt to two 12 volt batteries on each circuit.

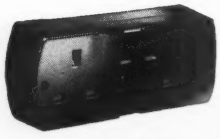
Write for full details of the Davenset range of Battery chargers and engine starters suitable for 200/250 volt AC mains.

Designed from first to last

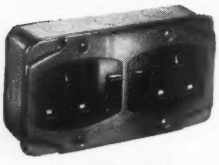
Double the use of each outlet . . .



MK 145 DHB



List No. 2949



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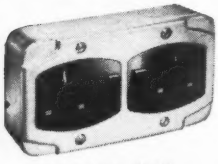


List No. 2946

List No. 2947

List No. 2948

TWIN SWITCHSOCKET-OUTLETS ARE THE ANSWER

In the planning of an electrical installation, there are certain 'natural' sites for socket-outlets. At the bedside, over the kitchen work top and on both sides of the fireplace are just three instances.

The fullest use of these natural sites can be obtained by using the new MK twin switchsocket-outlets. MK twin units double the efficiency of every installation at low cost. These new MK designs have switch control on both sockets.

The new range includes surface and flush all-insulated patterns as well as surface metalclad and flush metal units. The flush patterns have the same fixing-centres as the MK twin unswitched sockets. The two outlets are interconnected so that only one set of terminals is needed—a great saving on installation time.

MK . . . the mark of leadership

M. K. Electric Limited, Wakefield Street, London N.18 EDMonton 5151

Cut your costs with

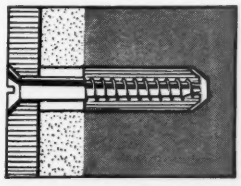
21 RAWLPLUG FIXING DEVICES

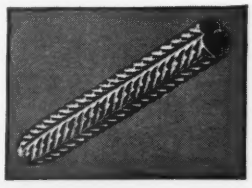
FOR SPEEDY FIXING IN ANY MATERIAL

No more trouble or costly delay because the material was 'difficult'! Whether it's concrete or plastic, breeze or sheet metal, cavity brick or lath and plaster, there's a Rawlplug Fixing Device that makes firm screw or bolt fixings quickly, easily and economically. The speedy answer to every fixing problem is one or other of the 21 different types of Rawlplug Fixing Devices. Write for illustrated brochure.

Screw Fixings

Use the famous RAWLPLUG for neat, firm fixings in brick, stone, etc. All sizes up to ¾" diameter Coach Screws. Rawlplugs are waterproof and unaffected by climatic conditions.

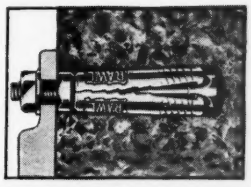


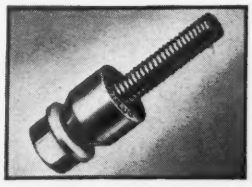


Rawlplug WHITE BRONZE PLUGS are specially suitable when the fixing is subject to very high temperatures, such as the outer brick coverings of furnaces. Use also for under-water fixtures.

Bolt Fixings

For bolting down machines, use RAWLBOLTS, a dry fixing that grips by expansion. No cold chiselling, no waiting for cement to harden. Sizes up to 1" bolt diameter.

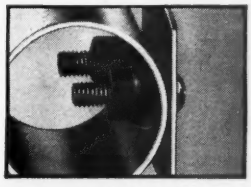


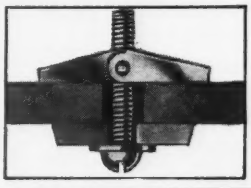


Use Rawlplug BOLT ANCHORS for bolting down in extremely wet or corrosive situations. Caulking completely seals the anchorage. Use also for anchoring Diesel Generators, Power Hammers, etc.

Cavity Fixings

Screwed up from the front the amazing RAWLNUT forms its own rivet head behind the material—airtight, watertight, vibration-proof, squeak-proof! For all thin or hollow materials.





For ceilings of lath and plaster, plasterboard, etc., use Rawlplug SPRING TOGGLES. The inserted Toggle springs open behind the material, spreading the load over a wide area.

USED BY THE MILLION THROUGHOUT INDUSTRY

RAWLPLUG FIXING DEVICES

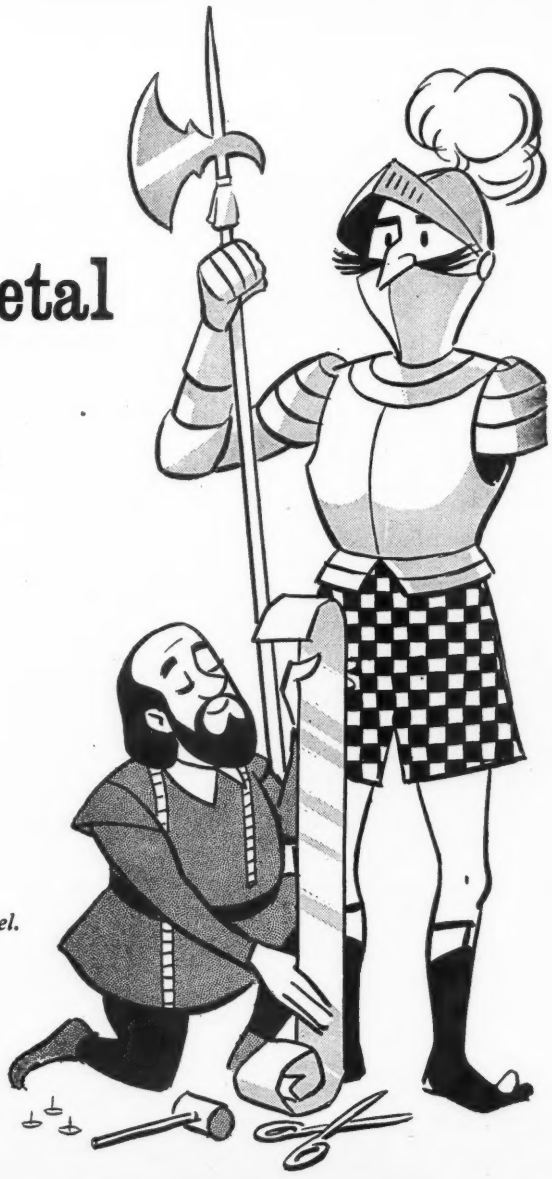
21 *different types of fixing devices for Speed and Strength*

Made by THE RAWLPLUG CO. LTD., CROMWELL ROAD, LONDON, S.W.7
The World's largest Manufacturers of Fixing Devices.

tailors in sheet metal

For centuries Midland craftsmen have
led the world in the art of tailoring sheet metal.

Today, combining new metals with
long acquired skill and experience, we
are making the products demanded by this
atomic age and offer a specialized
service to the electrical and
electronic industries.



Illustrated here is a switch-gear housing, an example of one of our many fabrications in sheet steel.

S. Taylor & Co. Ltd
John Grove & Son (B'ham) Ltd

145 LIONEL STREET, BIRMINGHAM 3. Telephone: Central 7781
Brookvale Road, Witton, Birmingham 6. Telephone: Birchfields 5051

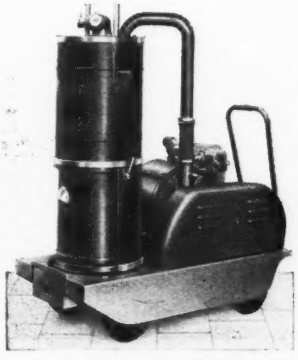
Members of the Warne-Wright Group
—who are large scale manufacturers of Nuts and Bolts, Repetition Parts, Stampings and Pressings and Drop Forgings for all Industries

STURTEVANT INDUSTRIAL VACUUM CLEANING

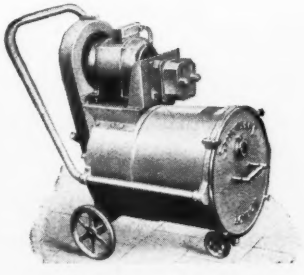
The need for cleaner working conditions has never been so essential and so closely allied to increasing output and quality, as it is today.

The high efficiency of Sturtevant Portable Vacuum Cleaning machines will meet the full surface cleaning requirements in factories of all types — collecting dirt, dusts, powders, granular materials, spillage, fly and swarf.

In addition, Sturtevant portable machines are very strongly constructed to withstand the wear and tear of arduous industrial duties. For further details please write for our **publication U/50007B.**



No. 6X—A very powerful two operator plant with a vertical filter having a capacious removable dust bin.



No. 5MT — Fitted with a three phase squirrel cage motor for continuous heavy duty operations.

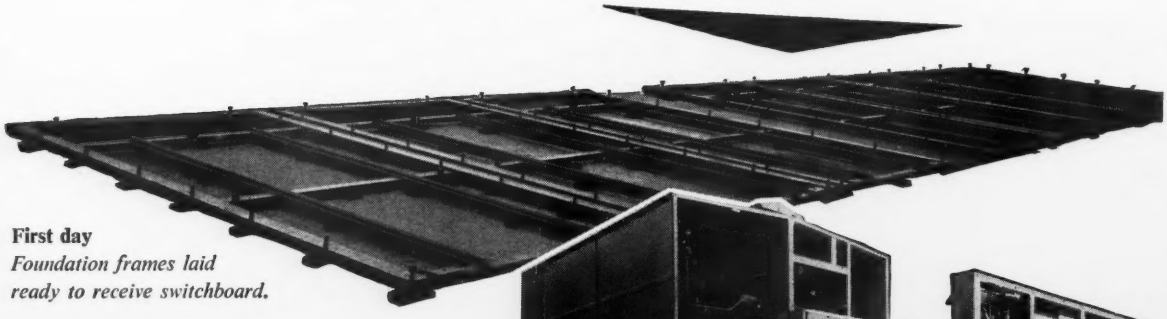
No. 4X — Particularly suited for the reclamation of granular materials and coarse spillage as it is fitted with a removable metal interceptor bin.

STURTEVANT ENGINEERING CO. LTD.

Southern House Cannon Street London E.C.4

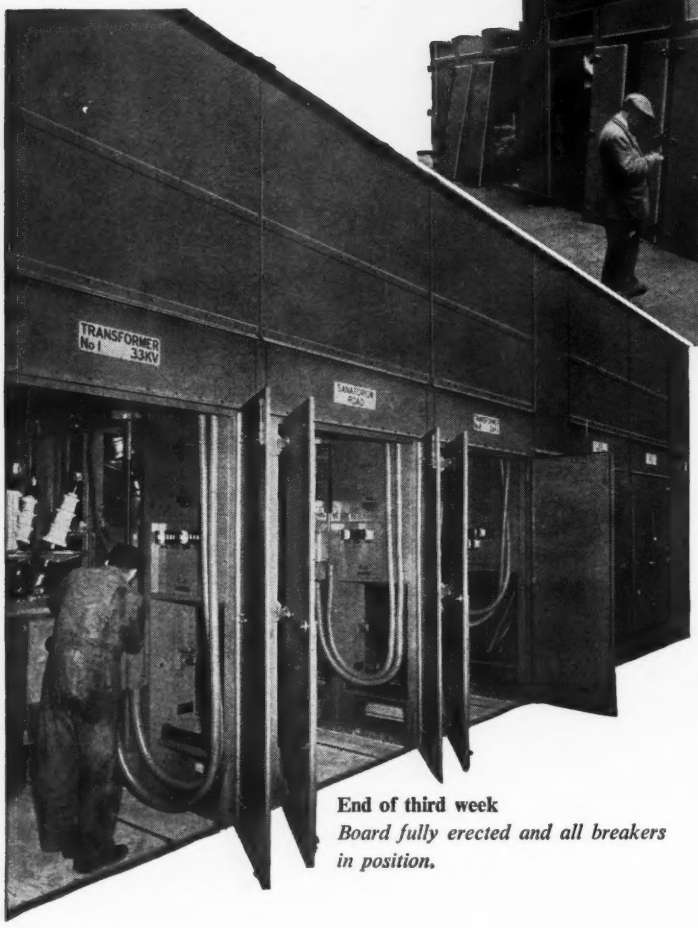
AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W.

33 kV OUTDOOR AIR INSULATED SWITCHGEAR ERECTED IN 3 WEEKS



First day
Foundation frames laid ready to receive switchboard.

Third day *Showing sides, frames, and two of the busbar chambers in position.*



End of third week
Board fully erected and all breakers in position.

Shown here is a 7-panel, 33,000 volt air insulated, metalclad switchboard installed in the centre of a large industrial area in South Wales. It was completed ready for cabling in 3 weeks from the laying of foundation frames. The space required for this 7-panel board is only some 60 sq. yards compared with an equivalent conventional outdoor sub-station of some ten times this area.

S·W·S

SOUTH WALES SWITCHGEAR LTD.

BLACKWOOD · MONMOUTHSHIRE · Works at BLACKWOOD and TREFOREST.

SWITCHGEAR, SWITCHFUSEGEAR, TRANSFORMERS, CONTROL BOARDS

TGA G21

THE YORKSHIRE COPPER WORKS LTD. • LEEDS AND BARRHEAD

METER BOARDS all over the world

... and in all climates

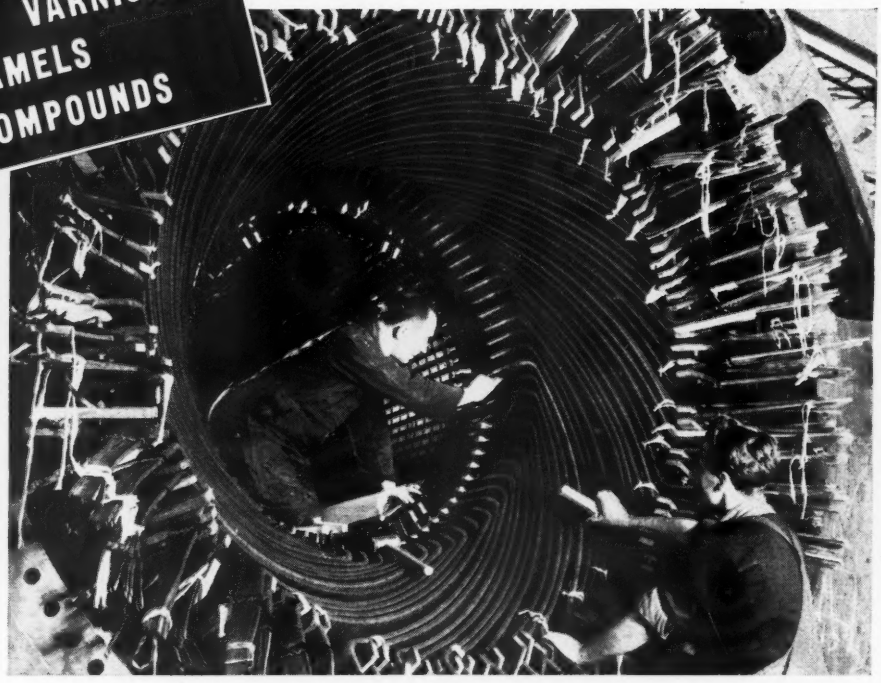
Our varied city and outback climates make Wootton Meter Boards the best choice. The pommies make it from quality plywood that's real dinkum. Easily fixed—gives me time for a cuppa !

WOOTTON

wood blocks, sunk switch boxes, instrument cases

WOOTTON & CO. LTD · ALMA WORKS · PONDERS END · MIDDLESEX · *Tel.: Howard* 1858

MINERVA
INSULATING VARNISHES ENAMELS AND COMPOUNDS



A Stator under construction

By kind permission of C. A. PARSONS & CO. LTD. Newcastle-on-Tyne.

We are constantly developing Special Varnishes to meet the many and varied requirements of the Electrical Industry. The tendency has been to concentrate on the development of Varnishes utilising Synthetic Resins. The advent of these Synthetic Types of Insulating Varnishes which have been developed by constant research over many years in our Chemical, Electrical and Physical Laboratories has enabled us to produce Insulating Varnishes to meet the most exacting requirements set by the Electrical Industry, thereby maintaining the high reputation and standard of 'MINERVA' Insulating Products.

Catalogue post free

STOVING VARNISHES (Natural Resin Type)
STOVING VARNISHES (Synthetic Resin Type)
THERMO-SETTING VARNISHES
SOLVENTLESS VARNISHES
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COPPER WIRE ENAMELS (Oleo-resinous and Synthetic Types)
All the above are supplied in black and clear.
ACID & HEAT RESISTING ENAMELS
Available in all colours
MICA BONDING VARNISHES
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CABLE LACQUERS (Non-flam., Cellulose Type and P.V.C.)
COMPOUNDS (Various Types)

All the materials listed conform to B.S. Specifications wherever applicable

Pinchin, Johnson & Co.

4 CARLTON GARDENS, LONDON, S.W.1

Telephone: TRAfalgar 5600

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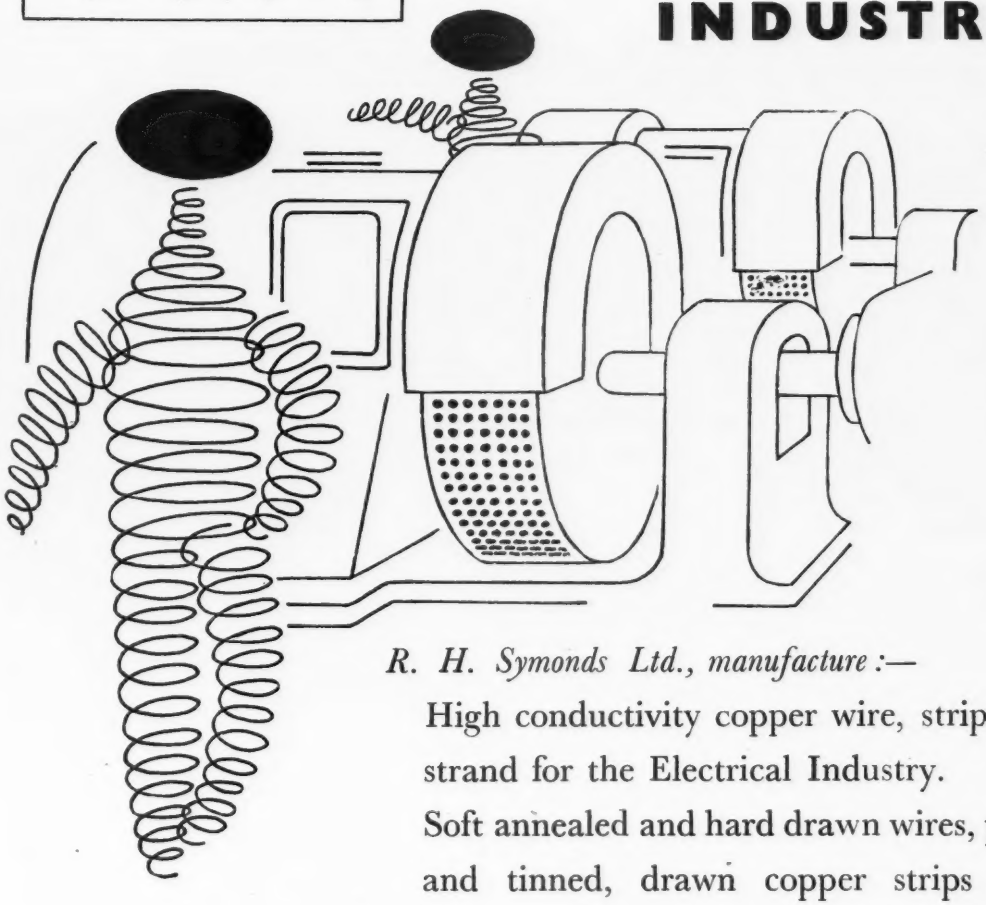
COPPER
THE LIVE WIRE IN INDUSTRY



R. H. Symonds Ltd., manufacture :—

High conductivity copper wire, strip and strand for the Electrical Industry.

Soft annealed and hard drawn wires, plain and tinned, drawn copper strips and copper strand.

Please telephone your enquiries to Abbey 2771/5 or write to the address below.

SUPPLIERS TO BRITISH RAILWAYS GOVERNMENT DEPARTMENTS, ELECTRIC CABLE MANUFACTURERS, TRANSFORMER AND ELECTRICAL MOTOR MANUFACTURERS AND OTHER USERS.

R. H. SYMONDS LTD.

47 VICTORIA STREET, LONDON S.W.I.

Works : Enfield, Middlesex.

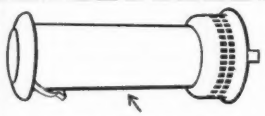
HOT FAVOURITE for the cold season

Belling Champion Convectors are selling faster than ever this year and our advertising and catalogues are busy putting over all their good points to your customers.
Make sure of your share of the cold weather profits—give plenty of showroom space to Belling Champion convectors and keep these sales-pulling points in mind:

- **High velocity convection rapidly circulates warm air**
- **Keeps the *whole* room warm**
- **All electric—no oil or liquid to fill or spill**
- **Specially designed long life elements operate at black heat**
- **Switch reduces heat when required**
- **One in the hall will warm both the hall and the landing**

and it's so safe

Mothers love the Champion; it's so safe, and light enough to carry from room to room. No exposed elements—low surface temperature—quite safe even when knocked over—cheerful glow from concealed red lamp—can be stood anywhere in the room.



Air space prevents damage if knocked over.

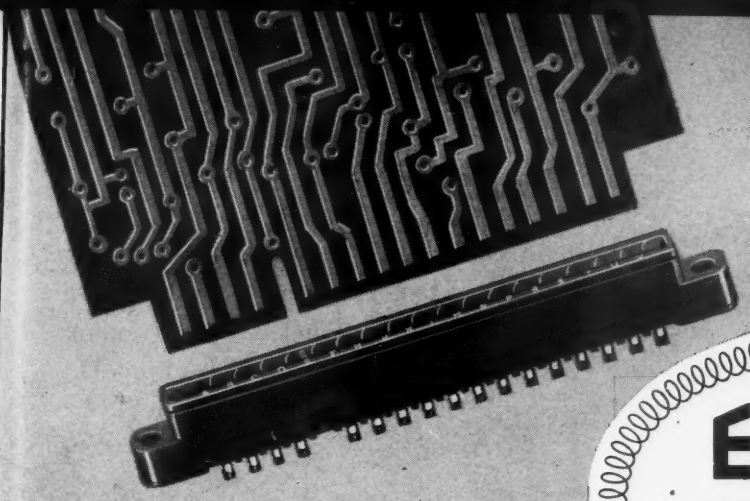
Three models to choose from:

91A 2-heat ¾kW **£5.4.5**
92A 2-heat 1½kW **£6.2.5**
83A 3-heat 2¼kW **£8.18.7**

"Belling"
HIGH-VELOCITY
Champion Convector

Belling & Co. Ltd., Enfield, Middlesex

CRC 450



This K-18 connector is ACTUAL SIZE —made under U S licence from Winchester Electronics Inc.

ELECTRO METHODS LTD OF STEVENAGE

— the foremost manufacturers of

printed circuit connectors

NOW AVAILABLE FOR PROMPT DELIVERY

SERIES 'K'
with 6, 12, 18 & 22 contacts
CONTACT CENTRES .156"
END FIXING
Solder-cups or rivet ends

❋

SERIES 'KKM'
with 6, 10, 12, 15, 18 & 22 contacts
CONTACT CENTRES .156"
END FIXING
Solder-eyelets

❋

SERIES 'KM'
with 14, 21, 31 & 37 contacts
CONTACT CENTRES .078"
END FIXING
Solder-eyelets

❋

Polarising-pins can be fitted in any position (This applies to each series)

★

GOLD-PLATED CONTACTS
made from spring-tempered phosphor-bronze
provide low contact-resistance, prevent corrosion and facilitate soldering.

★

MELAMINE MOULDINGS
conforming to B.S.S. 1322
provide high arc-resistance, high dielectric and mechanical strength.

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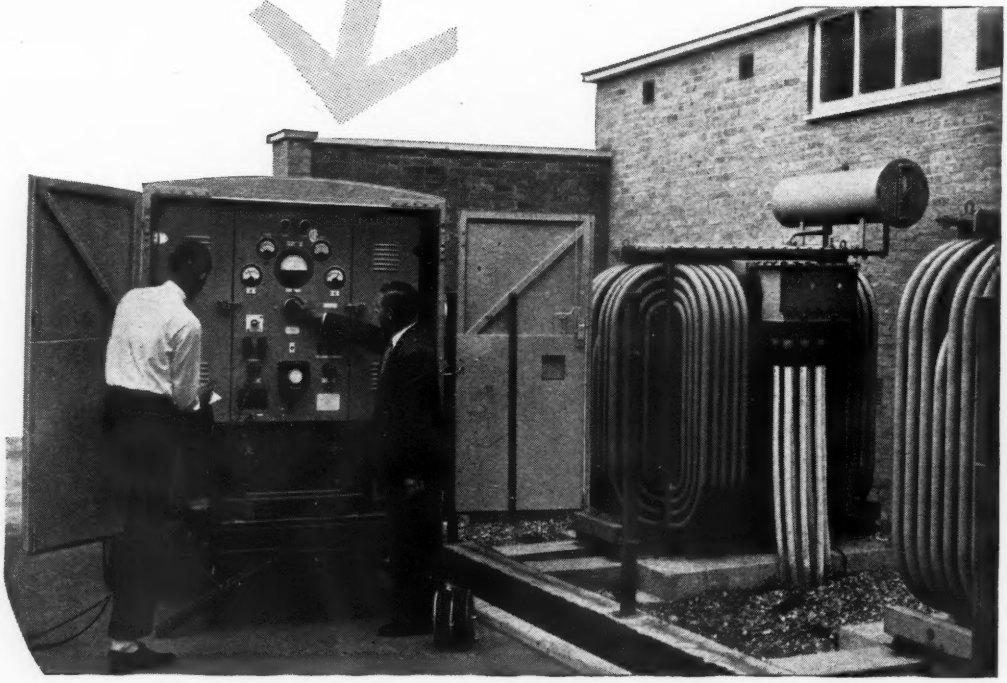

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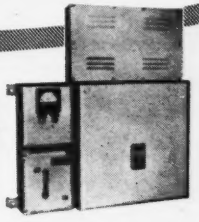
(Left) *Heavy Duty Direct On-Line Starters. Suitable for controlling motors up to 30 h.p.* **List DO 60.**



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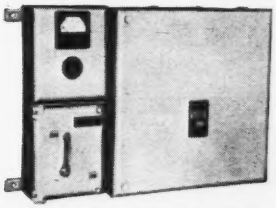
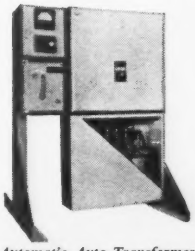


Heavy Duty Automatic Star Delta Starters. Suitable for controlling motors up to 55 h.p. **List SD 60.**



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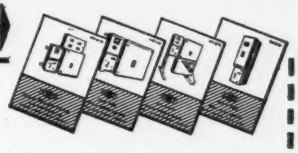

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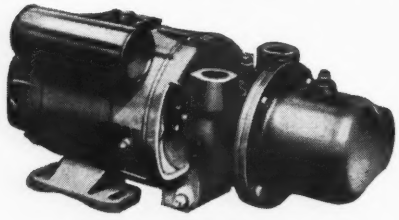

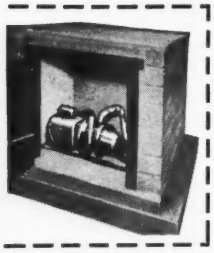

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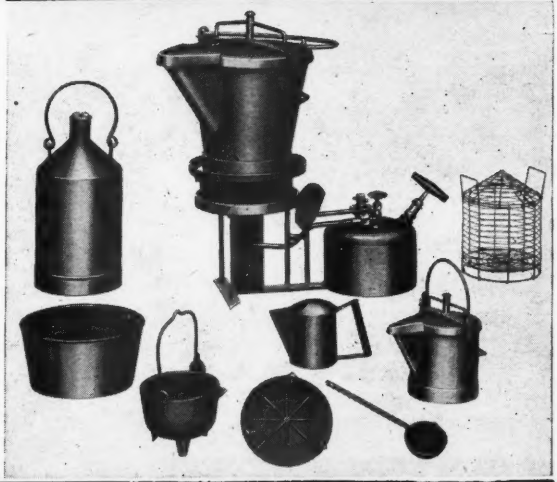

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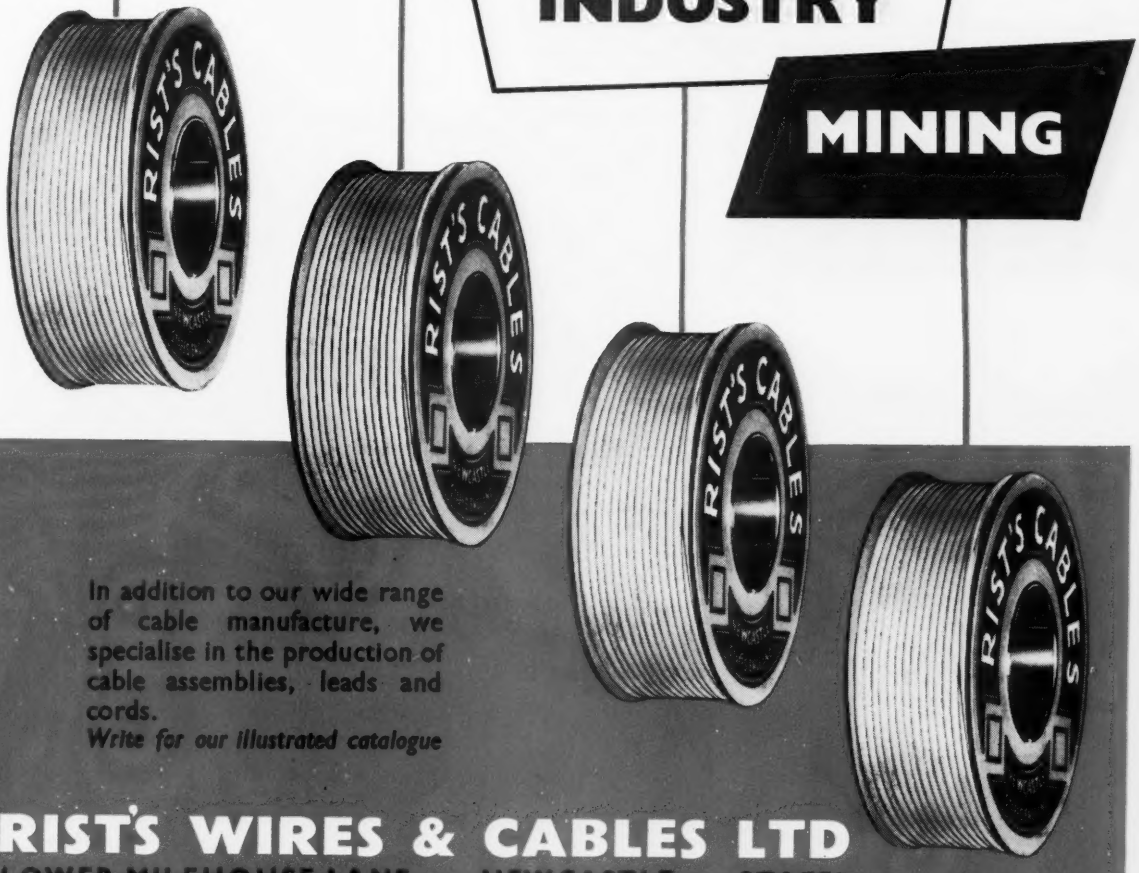

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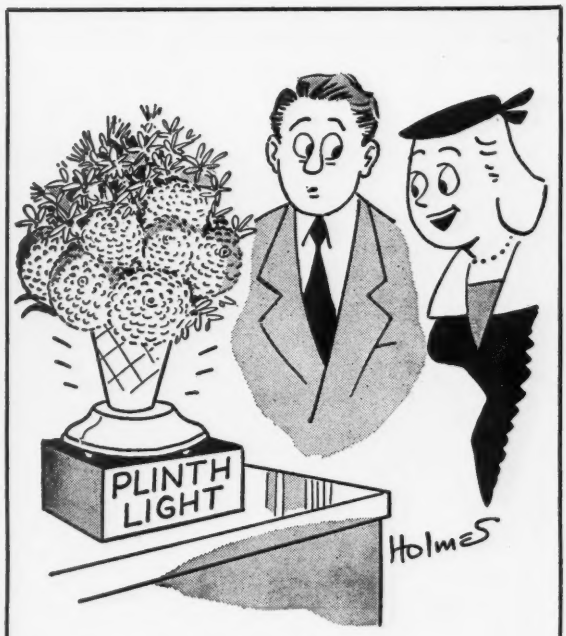

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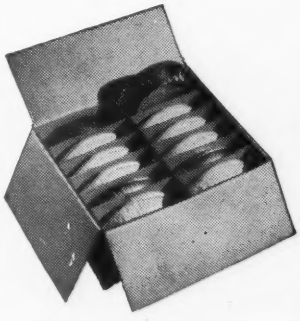

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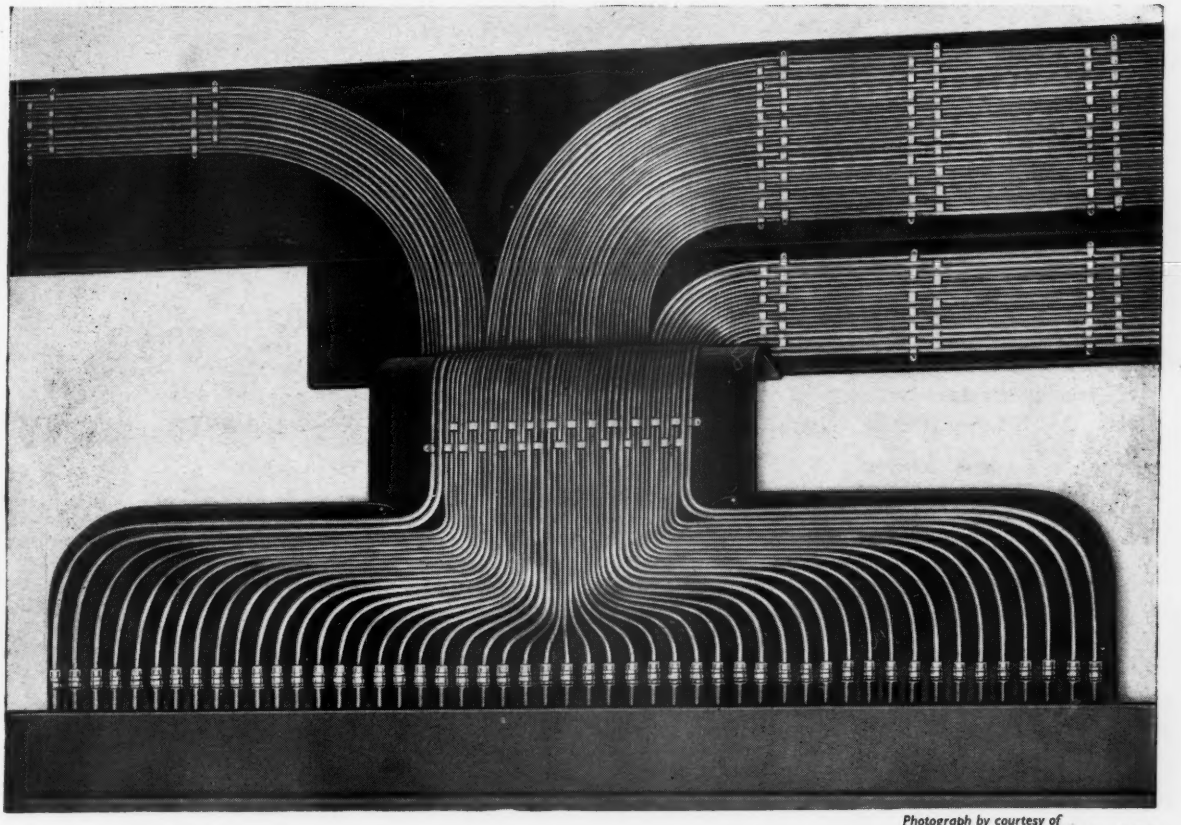

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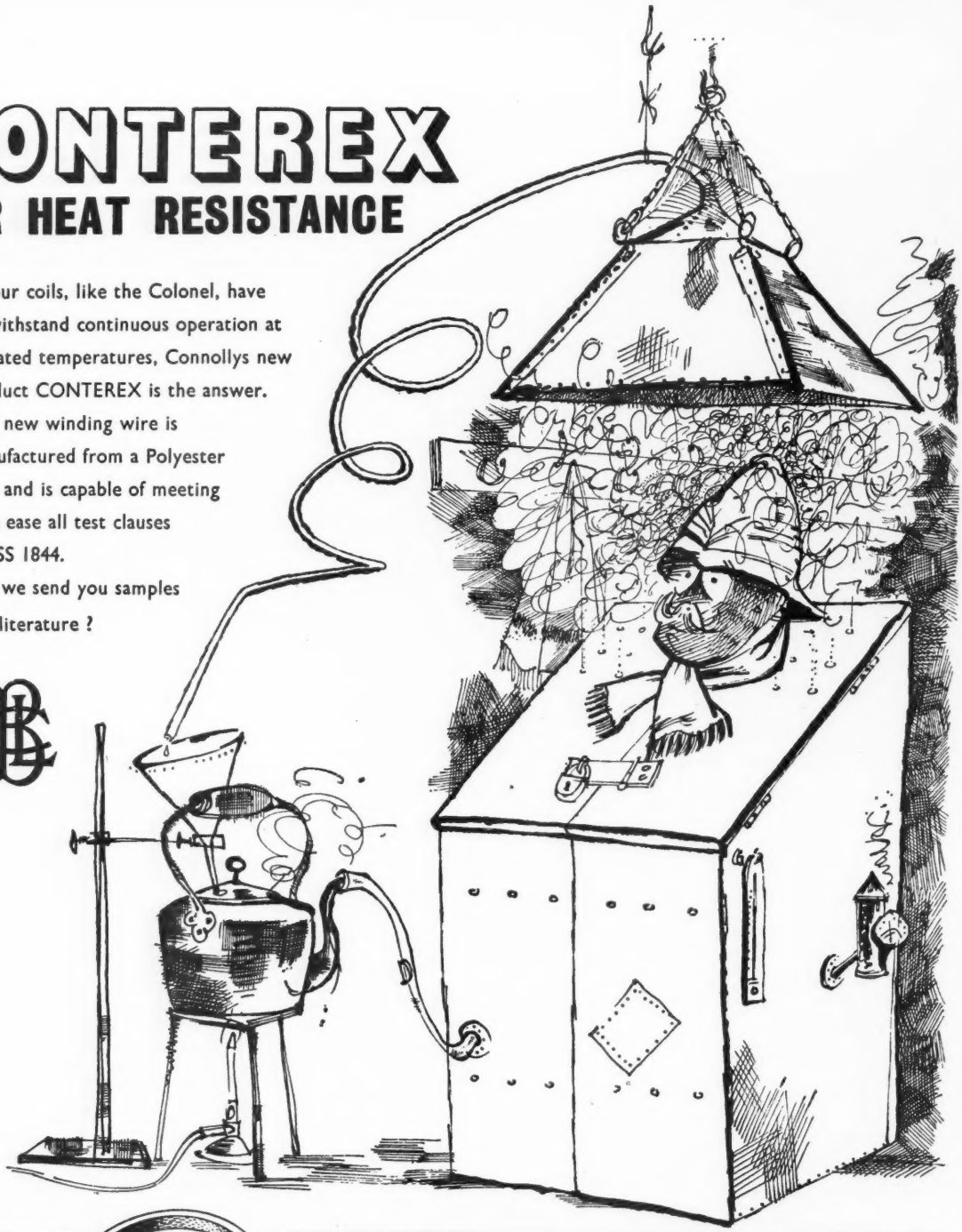

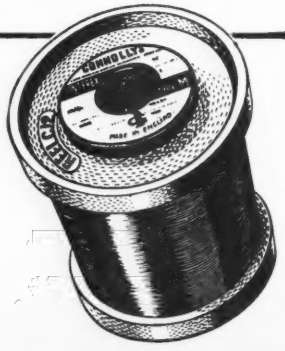

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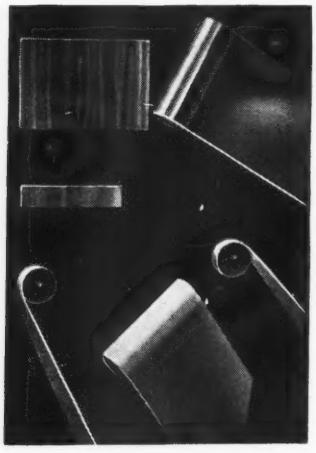

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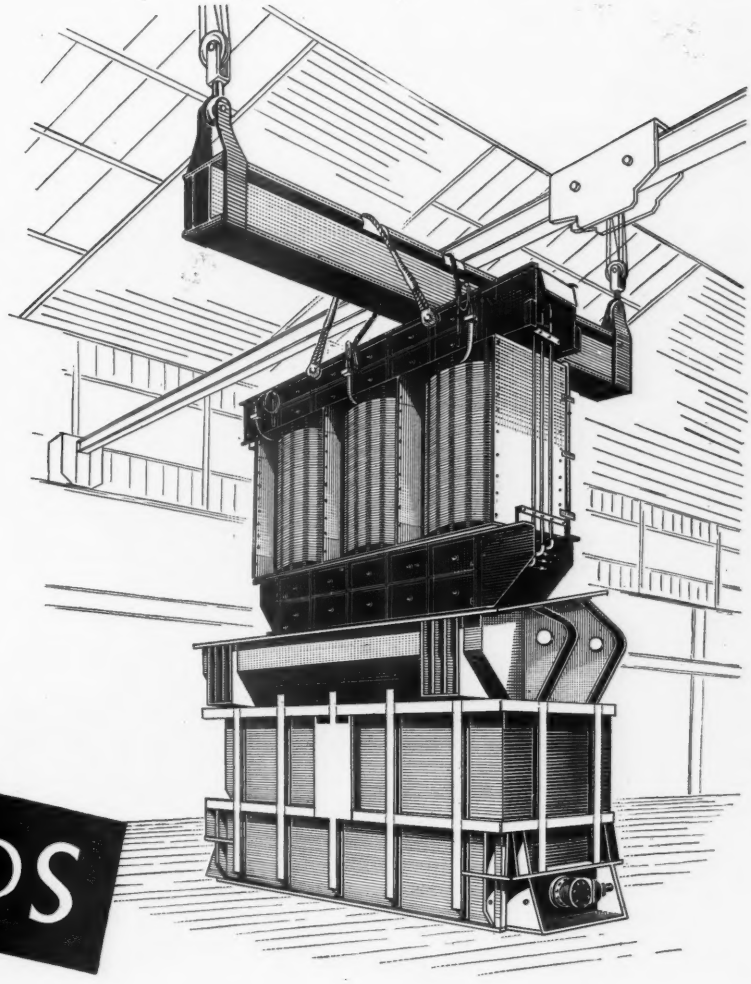

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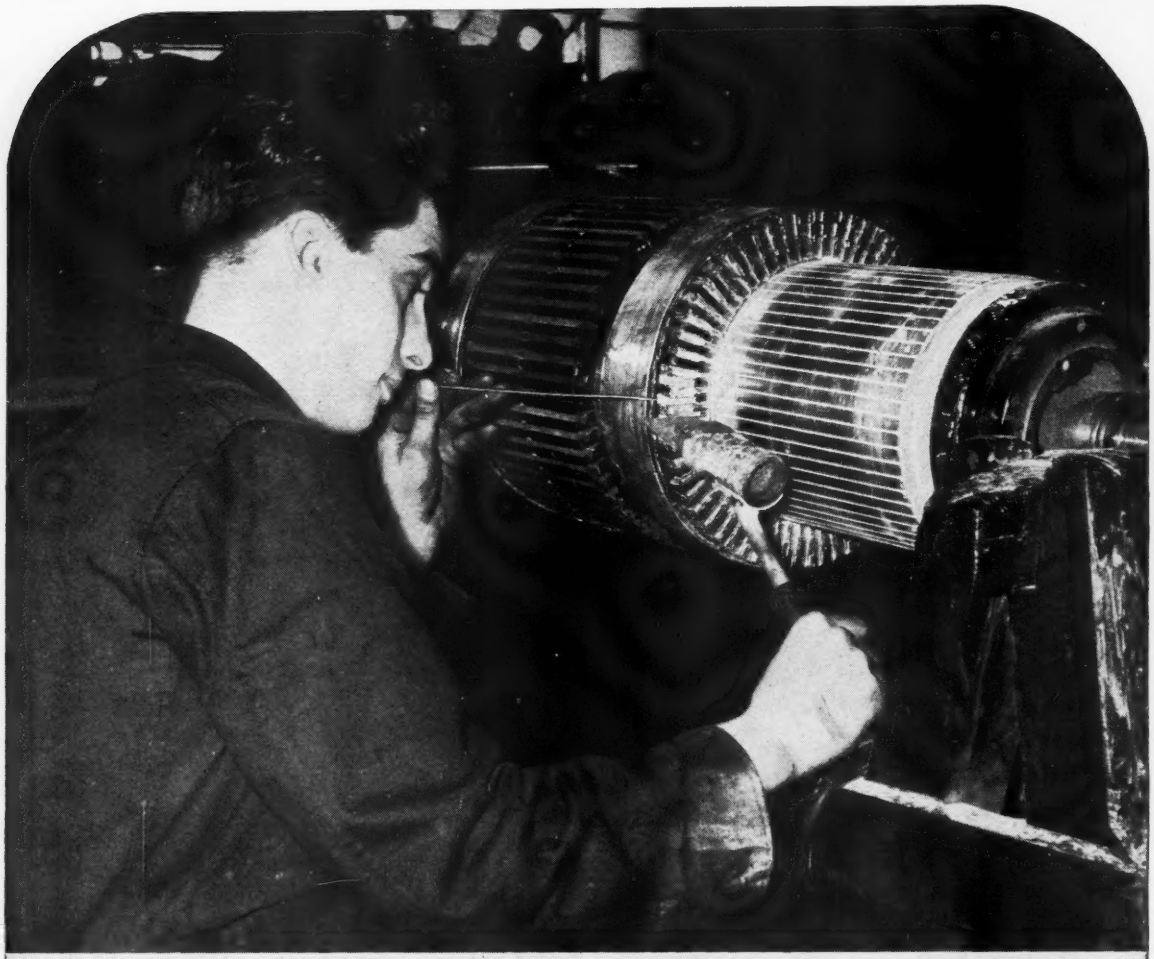

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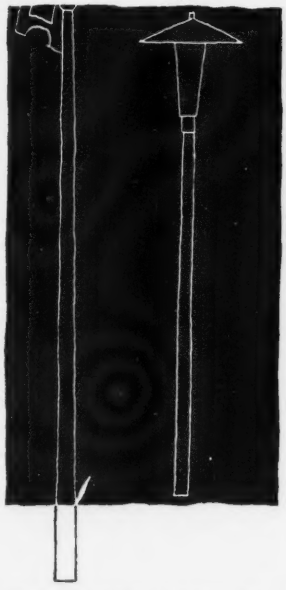
provides light on time at lower cost



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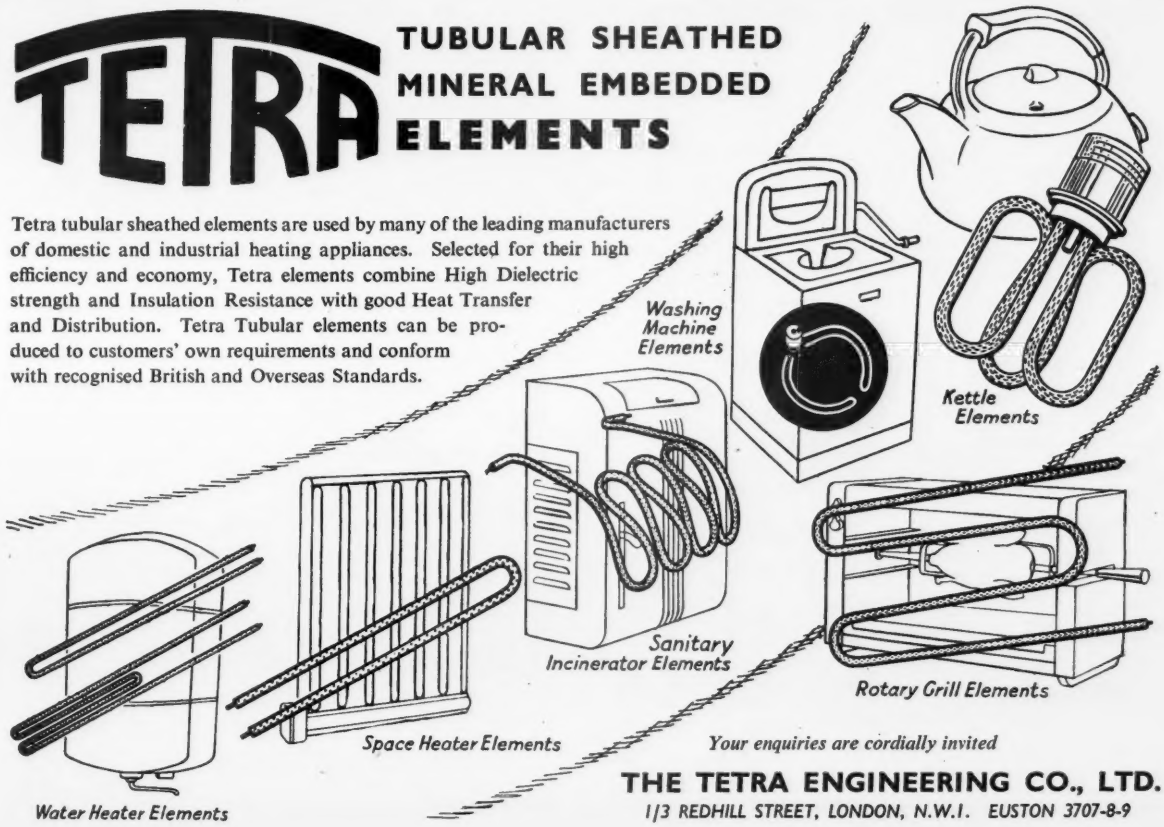

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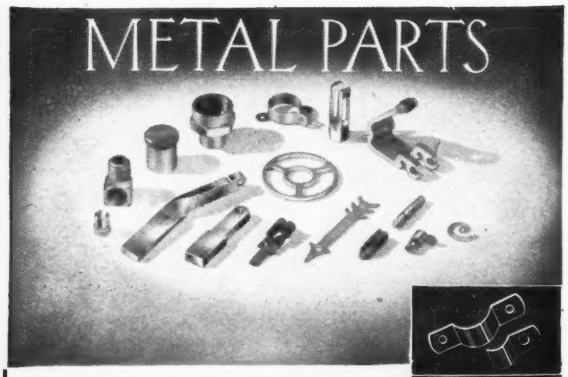

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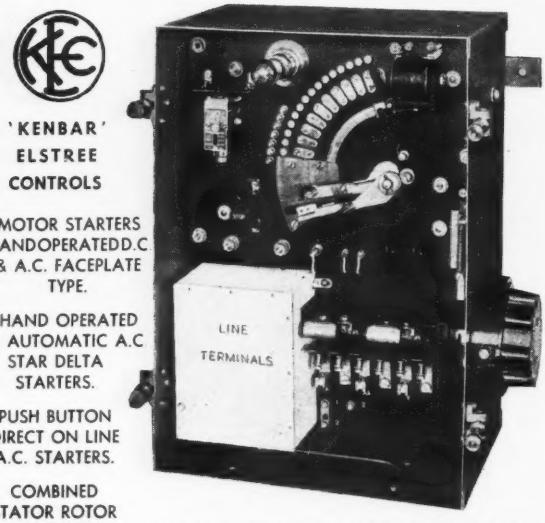

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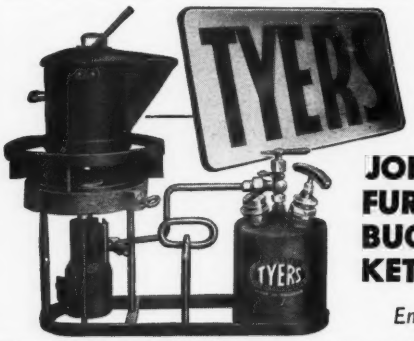

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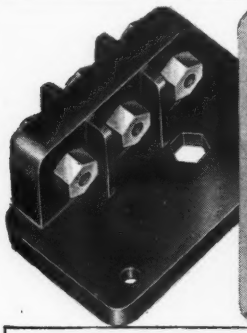

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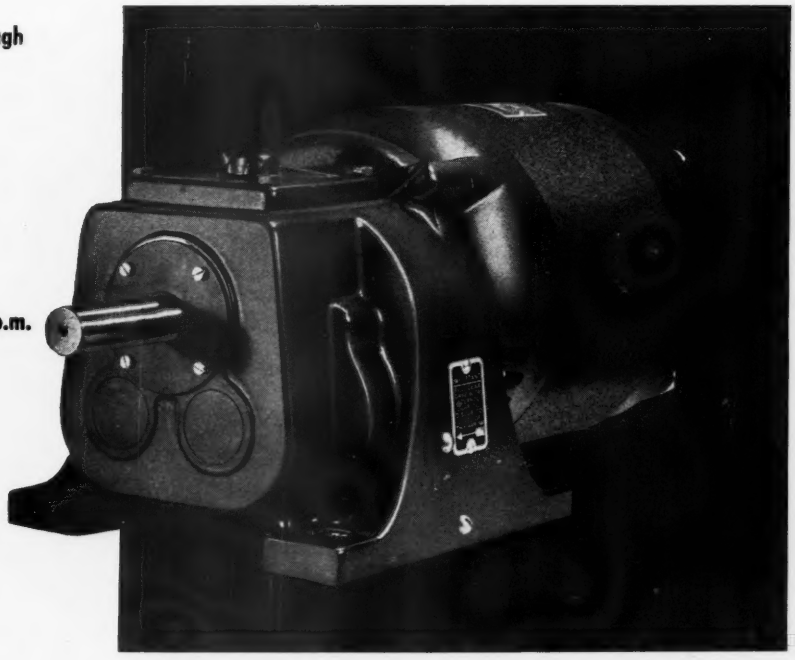

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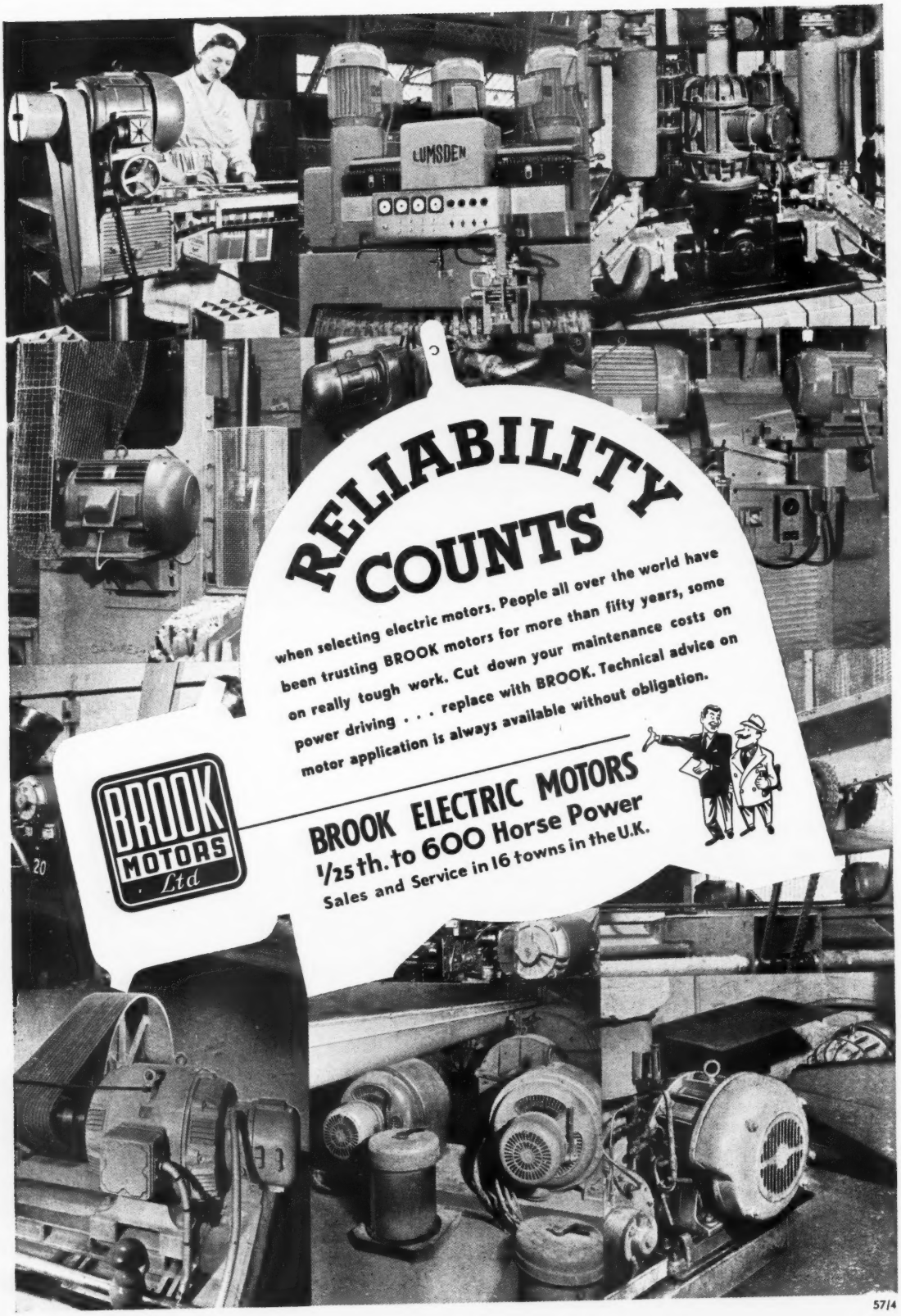
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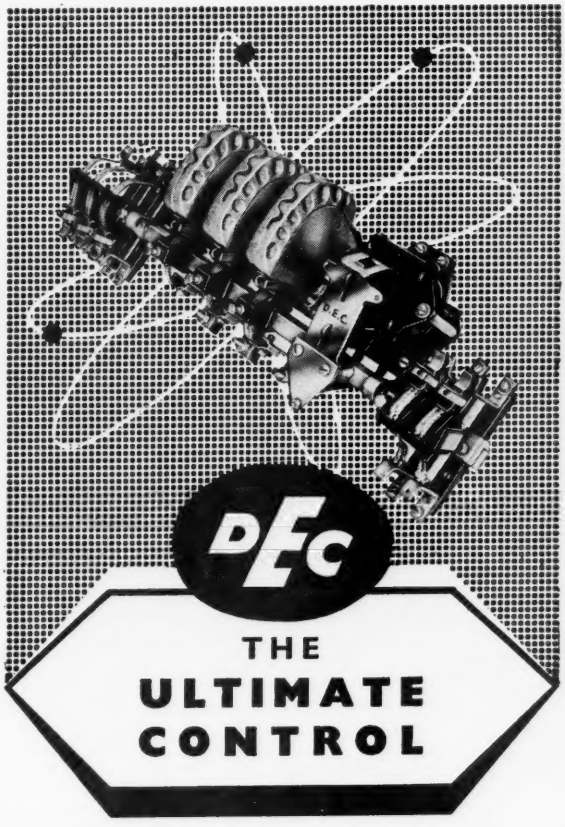

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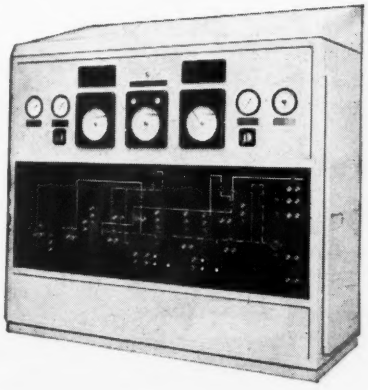

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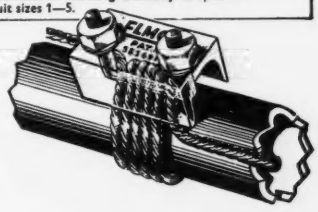
EARTHING CLAMPS

A COMPLETE RANGE TO B.S.951. 1948 IN 4 SIZES

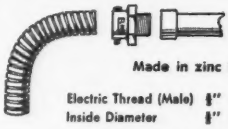
	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes	1, 2 & 3	4 & 5	6 & 7	8, 9 & 10
i.e. in trade terms	½" to ¾"	1" and 1¼"	1½" and 2"	2½" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

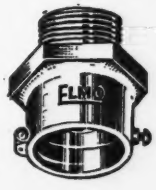
ELECTRICAL FITTINGS



Flexible-to-rigid
CONDUIT COUPLINGS

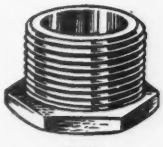
Made in zinc base alloy in the following sizes

Electric Thread (Male)	⅜"	½"	1"	1¼"	1½"	2"
Inside Diameter	⅜"	½"	1"	1¼"	1½"	2"
Electric Thread (Male)		⅜"	½"	1"	1¼"	
Inside Diameter Flexible Conduit		½"	⅝"	¾"	1"	



WITH EARTHING TERMINAL

Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal threads suit all makes of flexible tubing.



MALE
Hex. Section

CONDUIT BUSHES

Made in the following sizes:

MALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

FEMALE: Electric Thread
⅜" ½" 1" 1¼" 1½" 2"

FEMALE
Flat Face Section for Spanner (except ⅜" size, which is round)

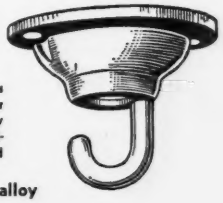
CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ⅜" thread, male electric.

Made to fit all standard boxes with two holes 7/32" diameter — 2" centres diametrically opposed. Designed in accordance with British Standard Specification.

Both made in aluminium alloy

CEILING PLATE
One hook



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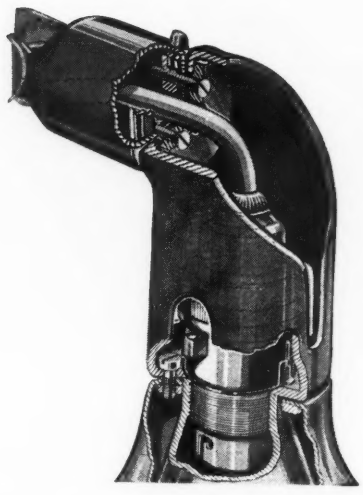

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The Swivelling Head carries the reflector and protects the lampholder from accidental damage, openings being provided for access to the push-bar. "Sudsproof" and "Edison Screw" types are also available. Six sizes of reflector.

Various lengths of arm (maximum horizontal reach 54 in.). With pillar or short vertical pivot. Bases for wall, bench, ceiling, floor or for mounting direct on machines. Also portable types.

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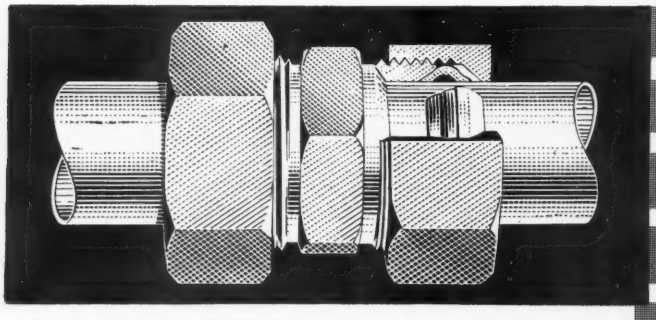

compression joints

and the safest

Simplifix Joints save time and trouble. Beyond removing the burrs no work is required on the pipe ends. As the securing nut is tightened, the sealing ferrule is compressed on to the pipe without weakening it in any way.
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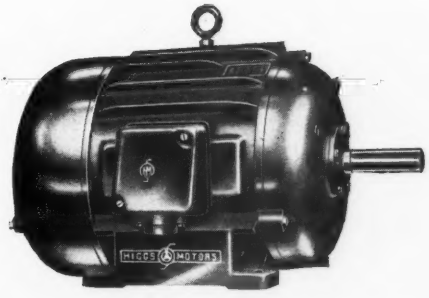
HIGGS MOTORS LTD.

MANAGING DIRECTOR DAVID C.Y. HIGGS, A.M.I.E.E.

BIRMINGHAM 6 ENGLAND



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THE wide scope of this multi-range AC/DC measuring instrument, coupled with its unfailing reliability, simplicity of use and high degree of accuracy, renders it invaluable wherever electrical equipment has to be maintained in constant, trouble-free operation.

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2 „ „ „	100 „ „ „
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10 „ „ „	1V „ „
50 „ „ „	5 „ A.C. & D.C.
100 „ „ „	10 „ „ „
500 „ „ „	50 „ „ „
1 A „ „	100 „ „ „
5 „ „ „	200 „ „ „
10 „ „ „	400 „ „ „
	500 „ „ „
	1,000 „ „ „

RESISTANCE

10,000 ohms, 100,000 „	using internal 1½ volt cell
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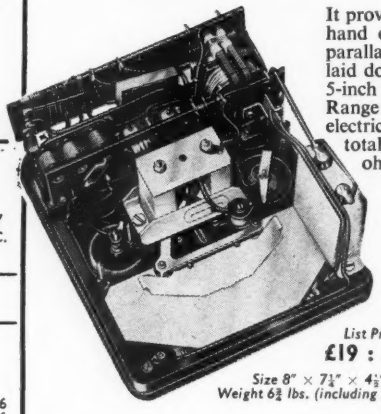
10 Megohms, 40 „	using external source of A.C. or D.C. voltage

CAPACITY 0·01—20 mFds

POWER AND DECIBELS

Impedance	Power	Decibels 0=50 mW
500 ohms	200 mW	—25 to + 6
5,000 ohms	2W	—15 to + 16
50,000 ohms	200 mW	—25 to + 6

Various accessories are available for extending the wide range of measurements.



It provides 50 ranges of readings on a 5-inch hand calibrated scale fitted with an anti-parallax mirror. Accuracy is within the limits laid down in Section 6 of B.S.S. 89/1954 for 5-inch scale industrial portable instruments. Range selection is effected by means of two electrically interlocked rotary switches. The total resistance of the meter is 500,000 ohms.

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The Ferranti Mercury Computer, an immensely powerful machine of enormous capacity, is exceptionally fast and provides facilities for the most advanced techniques of programming. Among many interesting features of this machine is the use of printed circuits produced from BAKELITE Copper-Clad Laminated Materials. Used in front to back inter-connected panels and for mounting special pieces of equipment in various parts of the Computer, they reduce the bulk of these assemblies, thus helping to keep down the overall size of the Computer. Reliability provided by printed circuits is of prime importance and their use eliminates the possibility of faulty wiring, thus making servicing and maintenance very much simpler.

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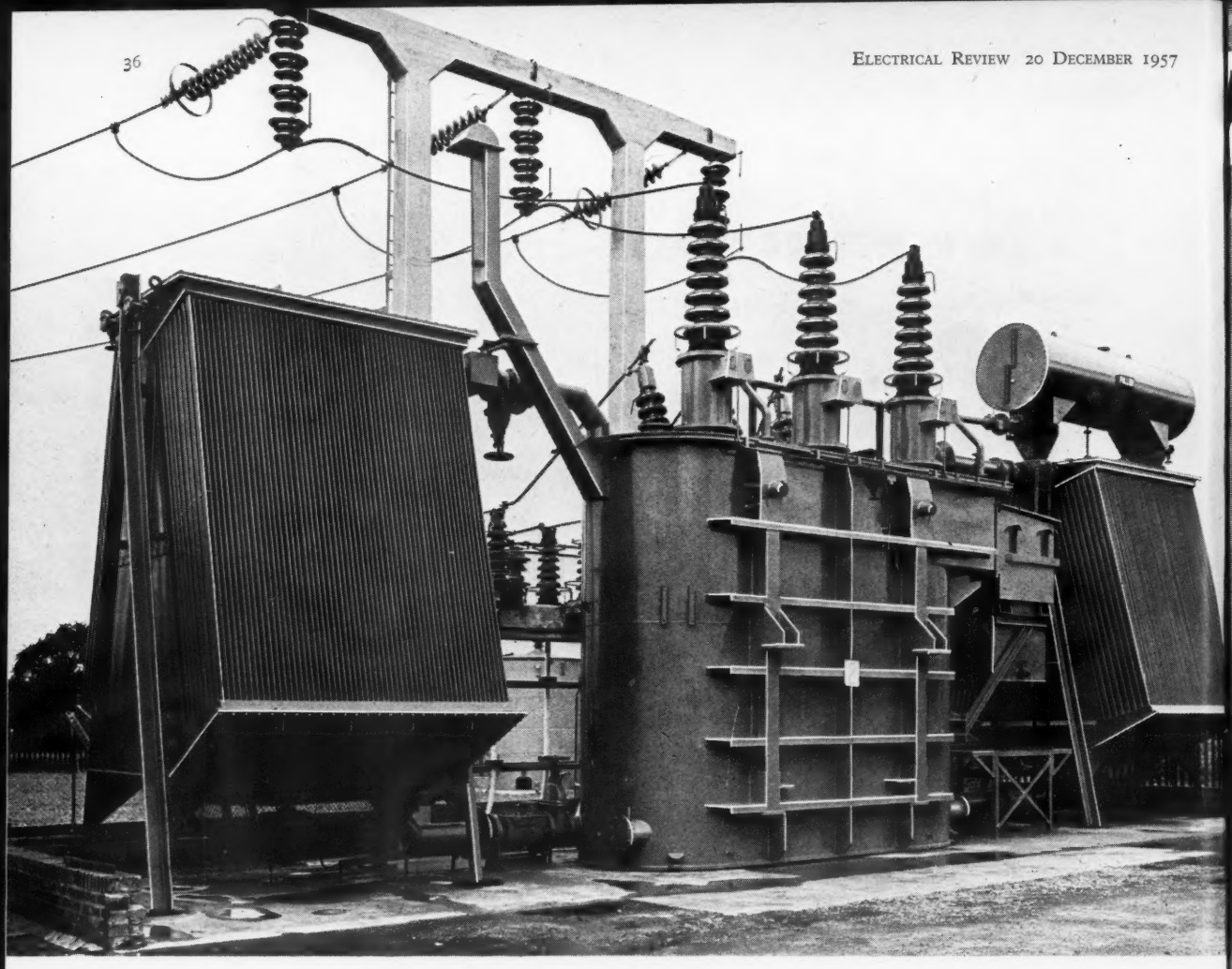

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up to the largest sizes
up to the highest voltages
built under ideal conditions
built to the most stringent specifications

Illustrated above is one of two 75 MVA 132/66kV ON/OFB transformers with high-speed resistor on-load tap changer, at Cheltenham 132 kV Grid Sub-station, Midlands Division, Central Electricity Authority.

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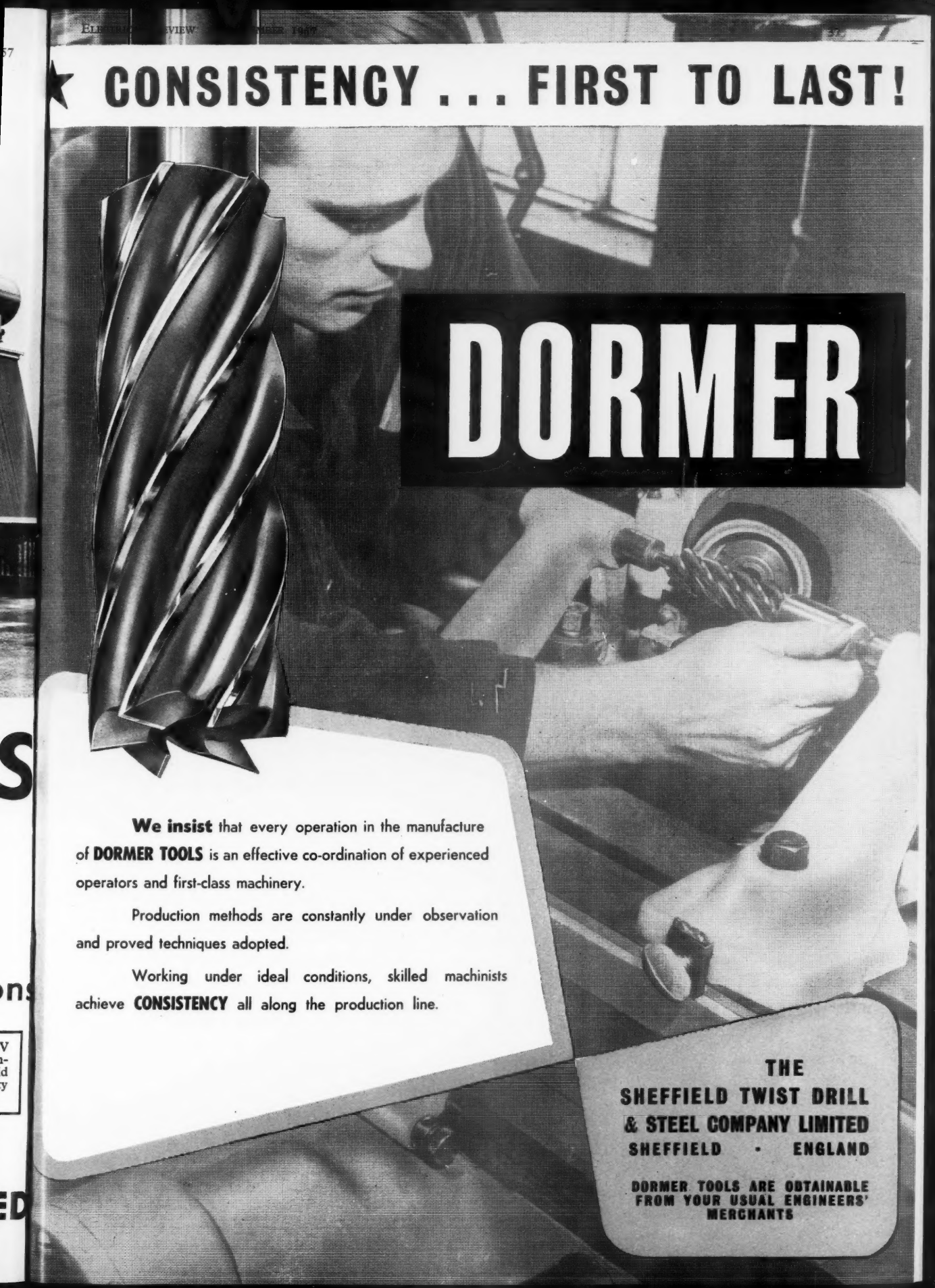
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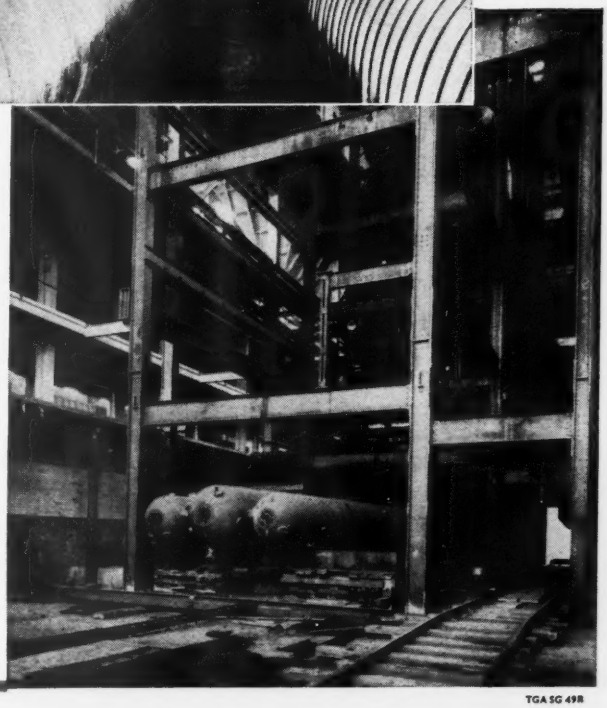

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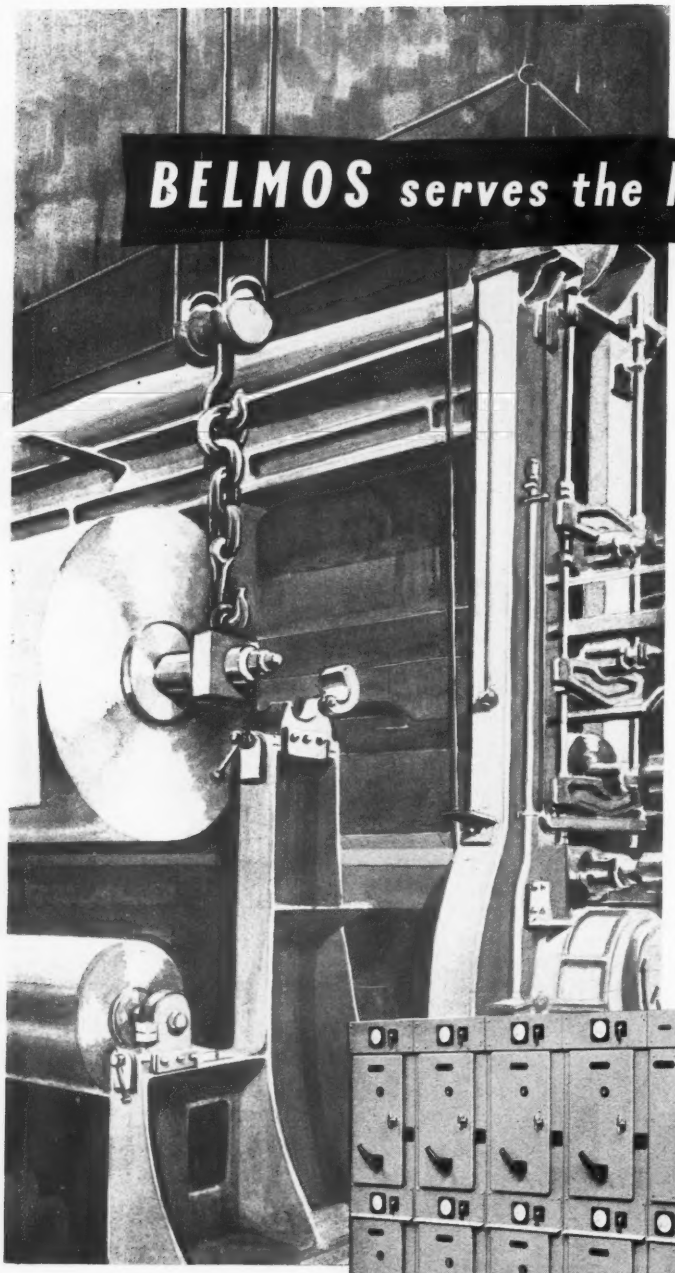

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There is little need to emphasise the part played by motor control gear in the making of paper. Belmos control gear has earned the complete confidence of plant engineer and management alike in the paper making industry throughout the world.

With over thirty years' specialist experience in the manufacture of switchgear and motor control gear, the company is justifiably proud of the part it is playing in the production of fine papers and boards.

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the

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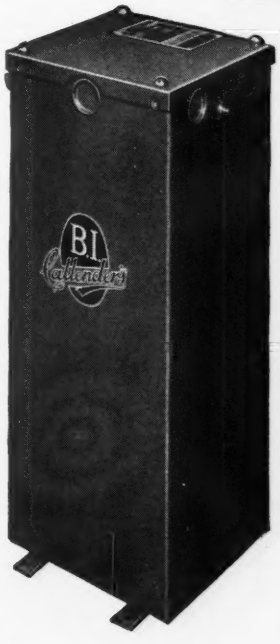
Both these types of tariff encourage consumers to obtain maximum power from the current they buy. BICC Capacitors *ensure* that they do.



Part of the current fed to A.C. motors, welders, transformers, etc., is not generally converted into useful energy. Capacitors reduce this idle component, so that less current does the same work.

Known as improving the Power Factor, this often means considerable savings in electricity costs. BICC Capacitors will usually pay for themselves in 18 months to 3 years!

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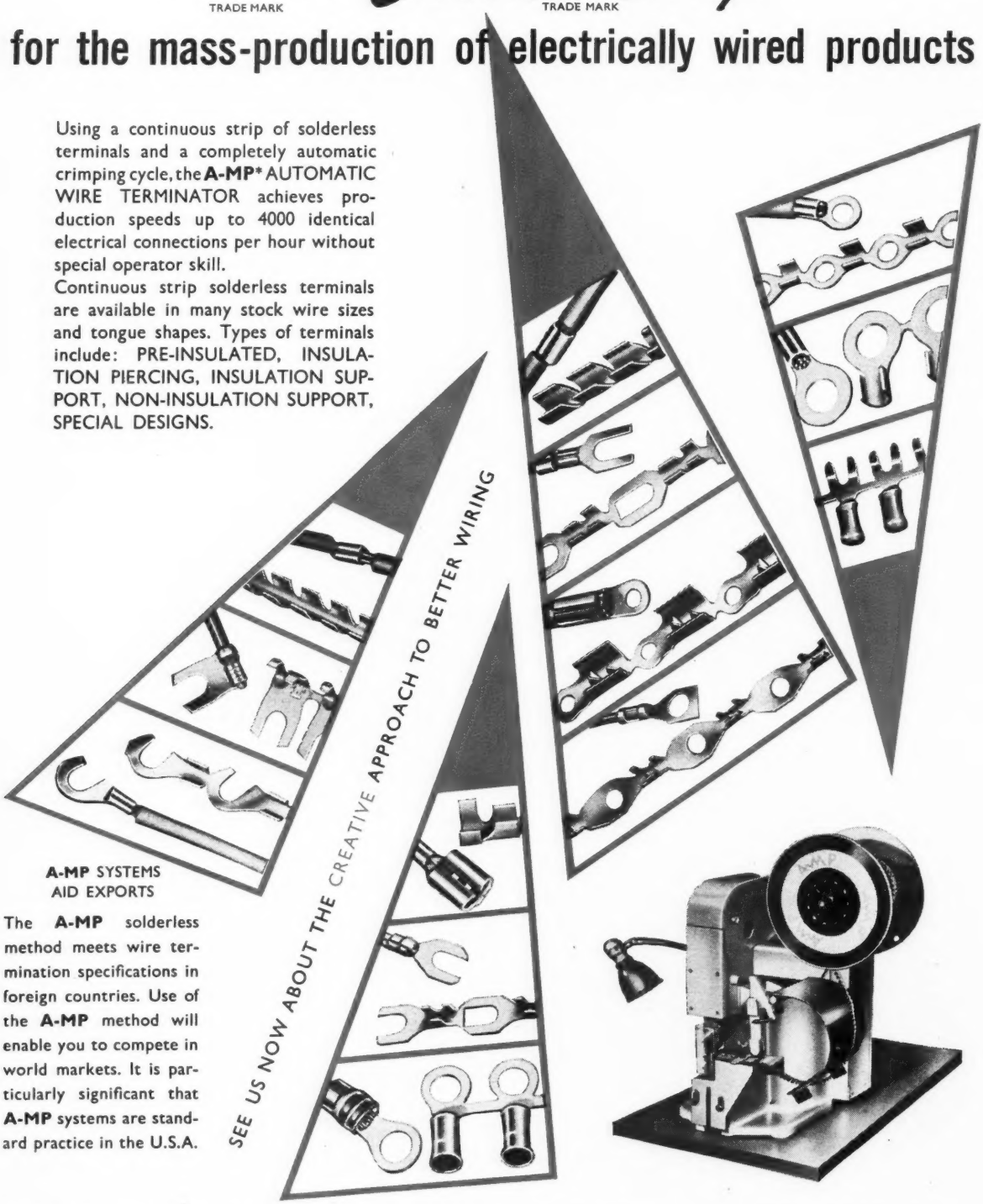
for the mass-production of electrically wired products

Using a continuous strip of solderless terminals and a completely automatic crimping cycle, the **A-MP*** AUTOMATIC WIRE TERMINATOR achieves production speeds up to 4000 identical electrical connections per hour without special operator skill.

Continuous strip solderless terminals are available in many stock wire sizes and tongue shapes. Types of terminals include: PRE-INSULATED, INSULATION PIERCING, INSULATION SUPPORT, NON-INSULATION SUPPORT, SPECIAL DESIGNS.



A-MP SYSTEMS AID EXPORTS

The **A-MP** solderless method meets wire termination specifications in foreign countries. Use of the **A-MP** method will enable you to compete in world markets. It is particularly significant that **A-MP** systems are standard practice in the U.S.A.

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H.R.C. FUSE-LINKS

Compliance with British Standard

B.S.88:1952 requires tests to be taken to prove compliance with the following:—

Clause 15:	Insulation Resistance.
Clause 16:	Temperature Rise at current rating.
Clause 17:	Time Current Characteristics.
Clause 18:	Minimum Fusing Current.
Clauses 19–22:	Short Circuit Performance.

All 'ENGLISH ELECTRIC' H.R.C. Fuse-Links to B.S.88:1952 listed in our Price List FG/127B have been fully tested to Clauses 15–22 inclusive proving compliance in all respects with B.S.88:1952 and Certificates of Short Circuit Rating have been issued by the Association of Short Circuit Testing Authorities.

IMPORTANT

When any change, however small, is made in design, materials, or methods of construction of an 'ENGLISH ELECTRIC' H.R.C. Fuse-Link likely to affect its performance, it is re-tested to Clauses 15–22 inclusive and proved to comply with B.S.88:1952 in all respects before being manufactured for sale.

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and be safe

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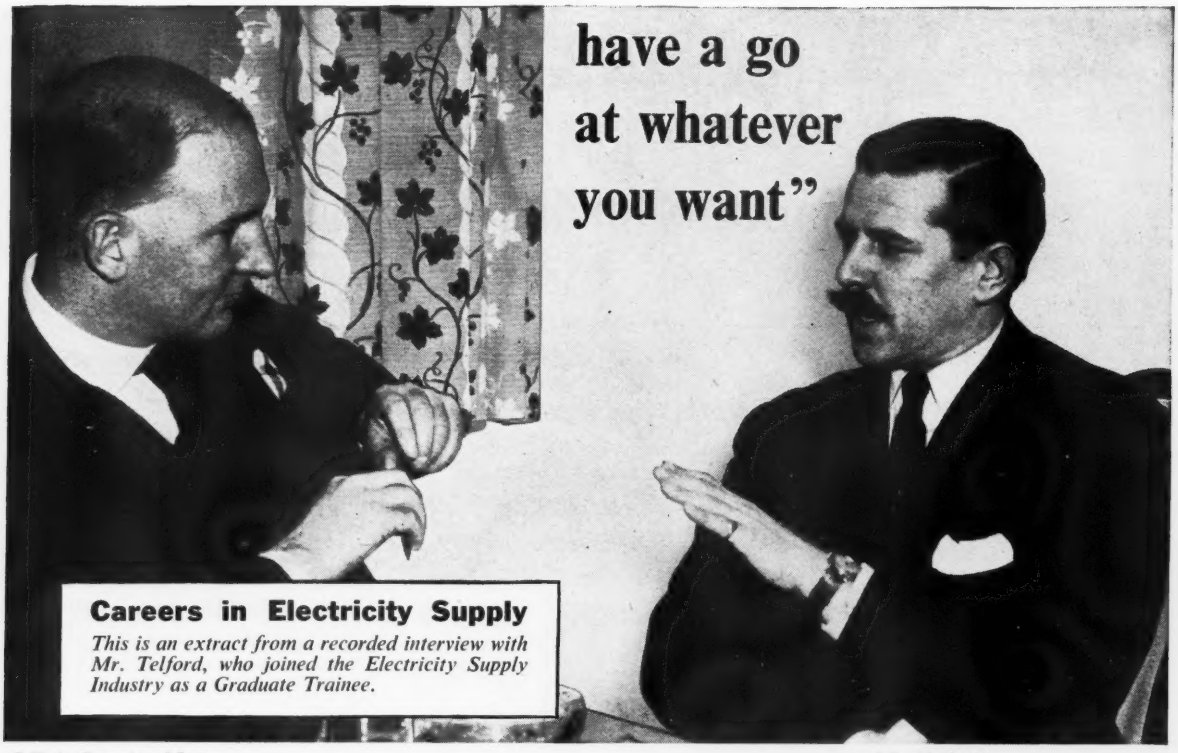

Careers in Electricity Supply

This is an extract from a recorded interview with Mr. Telford, who joined the Electricity Supply Industry as a Graduate Trainee.

C.E.A. Question Master — *Mr. Telford.*

Question Master: **I think we might begin by asking what was your first job in Electricity Supply after your training was finished?**

Mr. Telford: Well, my training was interrupted by the war, and it was only in 1950 that I finished my graduate course in the industry. I was then appointed Shift Charge Engineer at Frome, Somerset—a small station but an excellent training ground. From there I went to Earley—a much bigger station of 120 megawatts—as Boiler House Shift Engineer; later I became Charge Engineer there, and for a while was Efficiency Engineer, as well.

Q.M.: **Your next step was London, wasn't it?**

Telf: Yes, I came to London as Second Assistant Engineer on the Divisional Staff, and later I was appointed Deputy Superintendent at Bankside Generating Station—the position which I hold now.

Q.M.: **Bankside is a pretty big station, and at 36 you're young, aren't you, to be a Deputy Superintendent? But what made you come to London in the first place?**

Telf: A chance came along to get some administrative experience at H.Q. level, and I thought I'd better take it.

Q.M.: **Does the Industry give many opportunities like that?**

Telf: It most certainly does. It gives you a complete opportunity to have a go at whatever you want, and what you think you're best equipped for. The man who wants to get on is helped in every possible way; I've attended several courses run by the Authority, not only on technical matters, but on subjects like personnel selection and industrial relations.

Q.M.: **You find your job gives you scope for managerial ability—dealing with people as well as machines?**

Telf: Yes, indeed. I don't think there are many better opportunities than in a power station, because you have something of everything. You have the mechanical side, the electrical side, the building side—and most of all, a number of people with varied interests and jobs.

Q.M.: **Now a word about newcomers to the industry. If you have a chap of ability who is prepared to get down to the task, what would you say his opportunities were like?**

Telf: I would say that he has really splendid opportunities. For one thing, a career in the industry is established on a very firm footing—you could do without a lot of things, but it's impossible to get on nowadays without electrical energy. Another point worth remembering is that a man coming into the industry has the choice of the entire country to work in — and there's no parochial approach.

We'd like to publish more of this interview, but there isn't space. For full details of the many careers in Electricity, both on the Distribution and Generation sides, and the salaried training schemes available, please write to :

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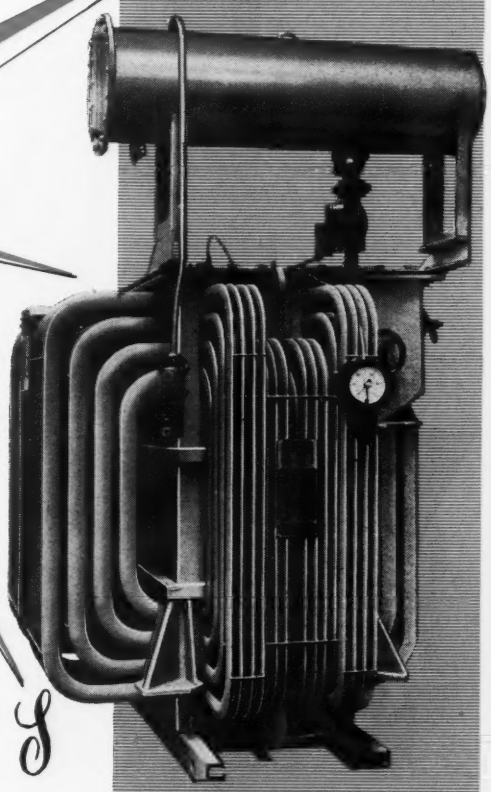

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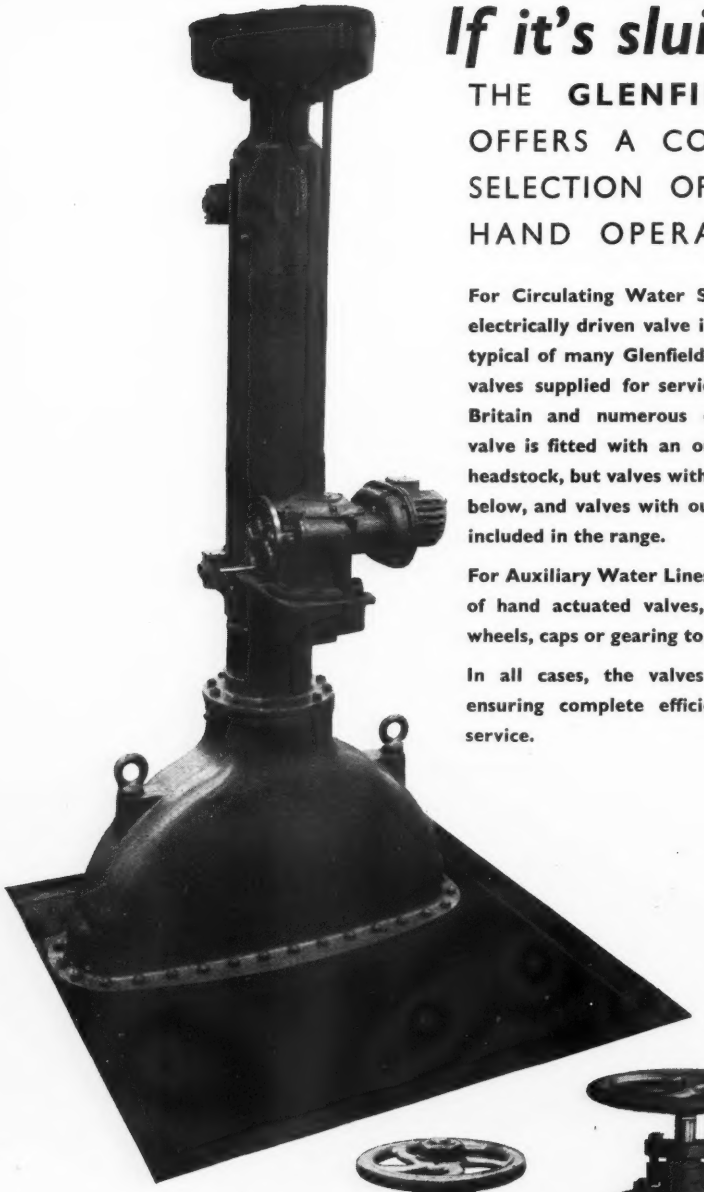

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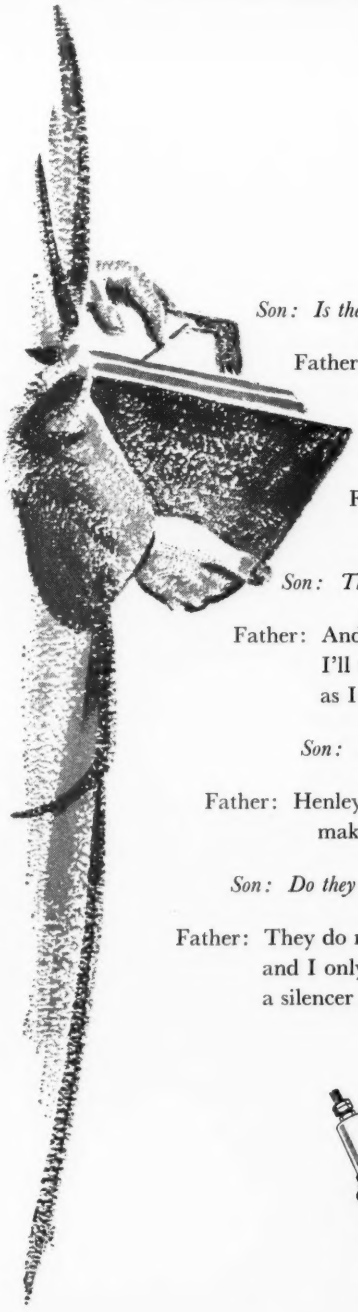

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Father: No, son — it's called an indoor terminal box.

Son: What's it for, Daddy?

Father: Well, er . . . I'll tell you when you're twelve.

Son: That's what Mummy's always saying.

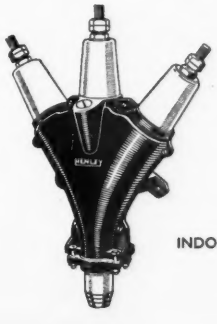
Father: And if you'll move over a bit, I'll telephone Henley's as I want some quickly.

Son: Henley's?

Father: Henley's are a large firm — they make these things.

Son: Do they make Roman Candles, too?

Father: They do not. They make electrical things, and I only wish their range included a silencer for small boys!



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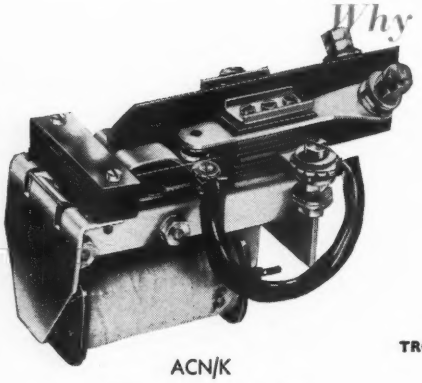

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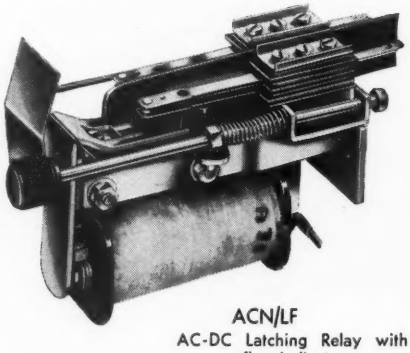

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ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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The suspension of the British Industries Fair has raised the general question of exhibitions. Opinion is in favour of specialised displays rather than comprehensive ones—whether national or international

Transmission Line Improvement 1103
Power capacitors connected to overhead lines can often result in appreciable reduction of losses. It is necessary, however, to ensure that their cost is justified in any particular case. The author considers this aspect as well as the methods of applying capacitors

Technique of Boiler Control 1107
There is a strong pressure towards centralised control layouts and a consequent need to reduce the size of instruments and panels to a point where one man can handle and scan several units without fatigue. Such a move to centralise control has brought in its wake a renewed interest in the electrical transmission and control of physical conditions

Advanced Power Reactors 1123
Dr. J. V. Dunworth, Head of the Reactor Division, U.K. Atomic Energy Authority, Harwell, in a lecture at the I.E.E. emphasised the importance of selecting the most promising reactor systems and concentrating the country's resources on them

Restrictive Trade Practices 1125
An account of what happens between the registration of an agreement and its final hearing before the new Restrictive Trade Practices Court

Electric Floor Warming 1129
After drawing attention to the requirements of a heating installation, the author of this A.S.E.E. paper describes the different methods of electric floor warming and the factors affecting the choice of system

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Tabulated data on tub capacity, loading, method of agitation, finish and price of the various makes, many of which are illustrated

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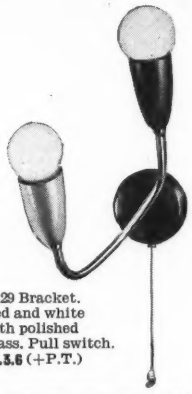

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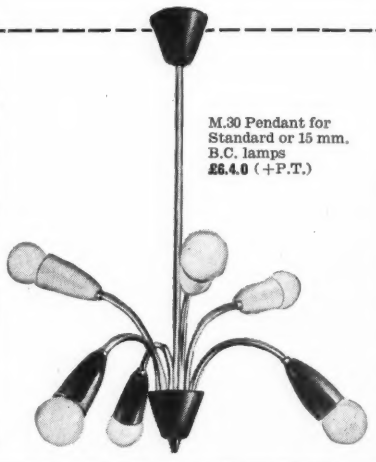

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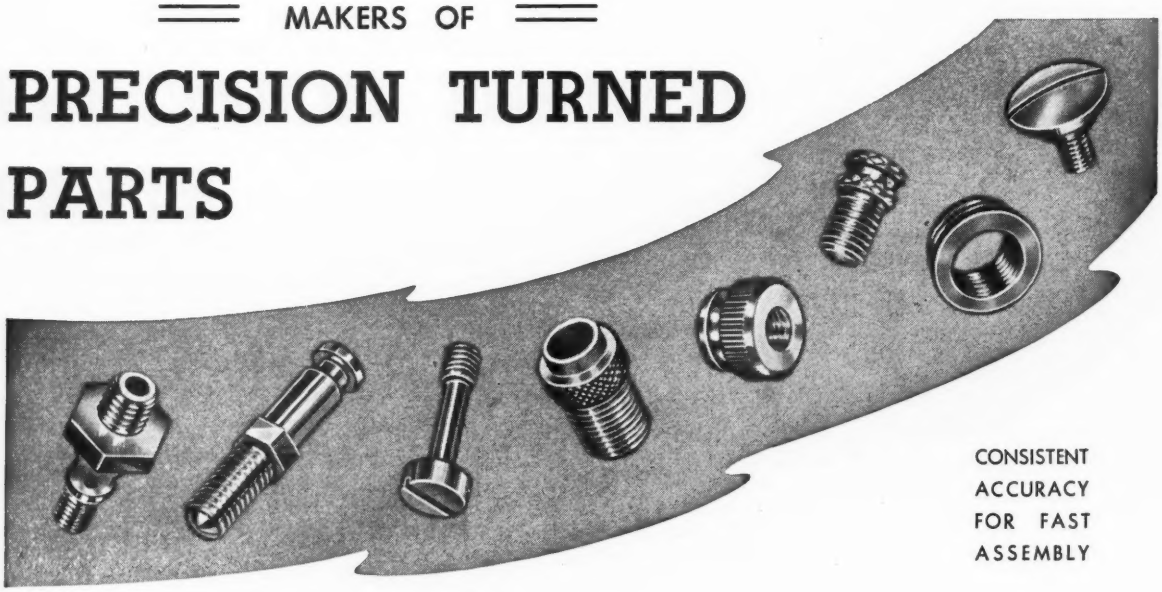

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ELECTRICAL REVIEW

20 December 1957 Vol. 161 No. 25 Established 1872

Exhibitions—Particular and General

As matters stand at the moment it is doubtful whether the British Industries Fair will ever be revived. This year the London Section was discontinued and although the Birmingham Section carried on it has been decided not to hold it next year. In fact the Birmingham Chamber of Commerce, which has organised the Castle Bromwich display since its inception, has announced that it will no longer be responsible for a Fair on the same basis.

The Chamber had in mind the " internationalisation " of the Fair and asked the Government to consider the possibility. The Board of Trade requested the Federation of British Industries to conduct an investigation and the F.B.I. has now announced the result of an inquiry which it made among its members. The Federation found that the " vast majority " of the trade associations approached (105 out of 109) were in favour of specialised exhibitions. There are said to be about sixty of these and about half of them are international in character. A substantial number of members indicated that they would like to see the scope of specialised fairs widened sufficiently to allow for the grouping of the products of allied industries. This, of course, already happens in some cases.

The F.B.I. says that now it has been ascertained that industry does not want a large general fair (which, to compare with other international fairs, would need one million or more square feet of exhibiting space), it is possible to consider what is required in order to give specialised fairs the modern exhibition facilities which they need. This difficult problem is to be the subject of a further inquiry by the Federation.

Electrical manufacturers find themselves involved in a large number of these special exhibitions, for electrical equipment is needed in every branch of industry nowadays. Also they now have the Electrical Engineers' (A.S.E.E.) Exhibition for the collective display of their products, to say nothing of the Power Convention Exhibition. On top of that many of them are contributing towards next year's International Exhibition in Brussels. With so many commitments it is not surprising that electrical concerns have drifted away from the B.I.F. in recent years. Although we were strong supporters of the Fair from the beginning, and helped to start and sustain the once-comprehensive Electrical Section at Castle Bromwich, we now feel bound to support electrical manufacturers in their reluctance to participate in a general trade fair.

There is a feeling that Great Britain, as one of the principal exporting nations, is backward in not having anything comparable to the great Continental fairs, but it probably suits us better to have special rather than general exhibitions. Anyhow, this is the view of the people most closely concerned—those who have to bear the cost—and we are bound to acquiesce.

REACTOR TYPES

So many are the ways in which the potentialities of nuclear fission can theoretically be applied to evil uses that it seemed at one time almost as though developments might be bogged down by a bewildering choice of alternatives. In his lecture to the Institution of Electrical Engineers, reported in this issue (page 1123), Dr. J. V. Dunworth showed how much more patient research remains to be done before some even of the more practicable types of reactor can be built economically enough for commercial purposes.

In one way it might almost be regarded as fortunate that Britain is faced with a coming shortage of indigenous fuel, since it has compelled a narrowing of choice to the Calder Hall design. First generally considered as something of a makeshift to meet immediate needs, pending further research, experience has shown it to possess greater merits than could have been foreseen in the early stages and to be likely to hold the field as a general basic type for the next twenty years.

FUEL SUPPLY BACKGROUND

At a recent conference on pulverised fuel, organised by the Institute of Fuel, the fuel supply background was discussed by Dr. G. H. Daniel who said that at the present time there was particular significance in trying to clarify the changes likely to take place in fuel supplies during the next decade or so. The revised nuclear power programme, and the arrangements that have been made for increasing the use of oil for electricity generation, mean that there will not be much increase in this market for coal over the next eight years.

The implications of this for pulverised-fuel firing are obvious, because the great growth that has taken place in the use of pulverised fuel in recent years has been almost entirely at power stations. On the other hand, the reduced rate of growth in power station consumption can be expected to result in the availability of abundant supplies of small coal for other uses. It is in the interests of all concerned that these developments should be assessed as early as possible so that appliance manufacturers, fuel consumers and producers may have time to make the necessary adjustments.

TECHNICAL EDUCATION

University education has always been regarded as the peak of our educational system. Technical colleges, despite the good work they have done for so many years and the many leaders of industry they have produced, have been regarded very much as second strings, and even the leading colleges have had buildings or scales of staffing, or equipment, inferior to those of universities. When Lord Hives recently introduced the first report of the National Council for Technological Awards he said the Government had made it very clear that they were determined to remedy these defects. so far as they could be remedied by Government action alone, and to enable the major colleges to stand alongside the universities as fully effective partners.

If the technical college student is to be regarded with the same esteem as his university colleague, then he must have received an equally good education and ultimately gain a qualification which in the eyes of his fellows is the equivalent in standing to a university degree. For many years the only qualification of university standard available to students in technical colleges has been the London University technical degree. Now, however, we have the Diploma in Technology or " Dip.Tech." and next year the Birmingham College of Technology will establish a landmark in the history of this award by conducting the first final examinations for the Diploma.

E.T.U. AND THE PUBLIC

The leaders of the Electrical Trades Union are understandably indignant that the B.B.C. should have permitted the presentation of a television programme in which they appeared in an unfavourable light. They were, however, given the opportunity of having their say but were content to refer the interrogator (Mr. Woodrow Wyatt) to a not-too-satisfactory Press statement which they had issued.

It is quite clear that many members of the Union are disturbed at the way elections to the Executive Council are run and an attempt is being made to arouse at least some of the 675 branches to call for an inquiry into the Council's activities. The Executive Council claims, of course, that the Union's affairs are no concern of the public. It may be right, but it is most definitely the business of the members, some of whom stand to lose their right to a livelihood by questioning the Council's methods. It has to be remembered, too, that trade union members are a substantial section of the public and if " private " endeavours to remedy grievances are unsuccessful trade unionists are justified in airing them in public.

PUBLIC LIGHTING SURVEY

In his presidential address to the Association of Public Lighting Engineers last September Mr. H. Carpenter referred to the proposal to resume publication of the statistical data on street lighting discontinued during the war. The first issue now available (see page 1131) covers returns for the year 1955-56 and includes information on types of lighting, methods of control, mounting heights, cost of energy, and expenditure on new schemes and improvements, which should be of considerable value to all concerned with street lighting.

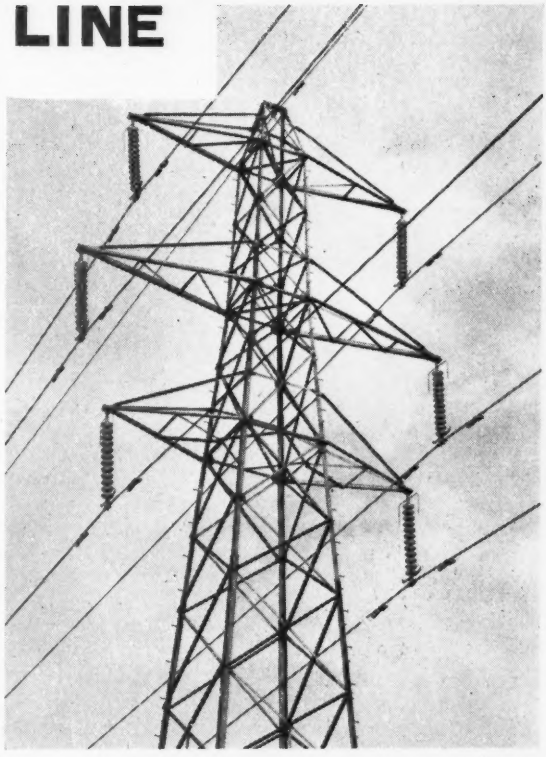
It was inevitable that in this first issue the data should be based on returns which lack completeness. While over a third of the municipal authorities in England and Wales sent in forms, there were replies from only a small proportion of urban, rural and parish councils and from Scottish authorities. It is hoped, however, that the usefulness of the booklet will stimulate a greater response to future questionnaires.

We extend to all our readers our
Best Wishes for Christmas
and the Coming Year

TRANSMISSION LINE IMPROVEMENT

Advantages and Disadvantages of Power Capacitors

By R. G. WOODWARK, D.S.C., M.A., A.M.I.E.E.*



THE world is using electricity in ever-increasing quantities and the demand in most countries still threatens to outstrip the supply. In this situation every potential saving is of enormous importance and it is thus pertinent to review every facet of the " manufacture " and " delivery " of electrical energy to see where and how waste can be eliminated and efficiency improved. An important part in this " business " is the transmission line carrying the product of the power station to the consumer, and this article considers the benefits obtainable by the incorporation of capacitors in the overhead lines of the transmission system.

The overhead line *per se* is but a part of the supply system and its efficiency is inextricably linked with the whole, for even the simplest supply system consists of the generator and the step-up transformer and switchgear, the transmission line and succeeding step-down transformers and switches at substations until the supply reaches the consumer at the required voltage.

So simple an arrangement seldom obtains in practice; in Great Britain most of the electricity generating stations are linked together by the grid to obtain an even distribution to the loads which are connected to various convenient points in the system. The generators must supply, however, and the grid must carry, not only the active current required by the consumer, but also the magnetising or " wattless " current needed for the inductive loads and, in addition, the magnetising current required for the characteristic induction of overhead line conductors themselves. Thus the total current transmitted over the grid and secondary lines, being a combination of the active and the " wattless " current, is greatly increased and the power factor is less than unity.

Effects of Low P.F.

The disadvantage of this " wattless " power (the kVAr of the load and line) is fourfold in effect:—

(a) Copper losses, which are proportional to the square of the total current, increase as magnetising current in the system increases.

(b) Excessive voltage fluctuations occur with variations in the load, and the voltage drop at full load is often unacceptable.

(c) The " useful " load that can be transmitted by the conductors is reduced.

(d) Generators may reach the limit of their capacity with respect to the designed kVAr output before reaching their maximum kW capacity.

Thus, any method which can improve the power factor or reduce the voltage drop, or both, will of necessity render the operation of the whole transmission system more effective.

The adverse effects of a low power factor have long been recognised by electricity supply undertakings and from the earliest days in many countries special tariffs and penalties have been imposed on consumers with high inductive loads taking lagging kVA. These tariffs resulted, as was intended, in the industrial users seeking to improve their power factor by installing equipment to take leading kVA. This, in turn, led to the development, *inter alia*, of the large condenser or power capacitor, which, by imposing a load of " leading " kVA, helps to offset the amount of " lagging " kVA that must be supplied.

During the past 20 years or so, the design, construction and efficiency of power capacitors have improved markedly. The modern outdoor capacitor is greatly reduced in size and weight compared with earlier counterparts of similar reactive kilovolt-ampere rating (referred to as the " kVAr " of a capacitor), and this greatly simplifies the problem of their installation in the somewhat restricted sites available. Recently developed dielectric media now enable capacitors to operate at almost uniform efficiency over a wide range of air temperatures. Thus the power capacitor, which can be installed as and where required and needs little or no maintenance, presents an attractive and practical method of improving the transmission line efficiency. Not only in theory is it effective; the first small consumer-installed units (mainly in shunt) proved their worth and more recently they have been installed with great benefit in high-voltage overhead line networks. Examples of these

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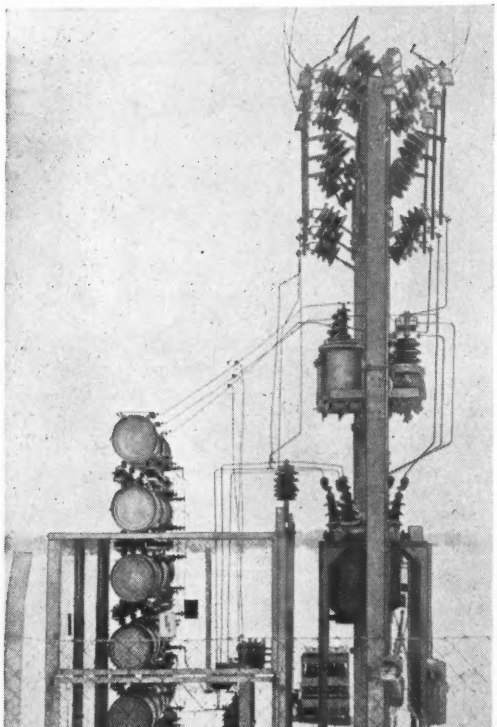


1 MVAr output series-connected capacitors on a 20 kV distribution line of 40 miles length (ASEA, Sweden)

installations are to be found in many parts of the world, and the U.S.A. and Sweden especially have invested substantially in power capacitors with some banks rated at up to 90 MVAr.

The power capacitor can be arranged, in single units or in banks of units, either in series with the load or in shunt or both; the selection of the particular arrangement depends on the loads and on the effect required. It is not proposed here to describe in detail the theoretical considerations relating to the operation of the capacitor, but the following points are of general interest in appreciating their effects.

The Shunt Capacitor

The power capacitor when arranged in shunt with a low power factor load, affords a marked reduction in the "wattless" current to be supplied by the generator. This saving is accomplished by virtue of the fact that the current it draws from the system leads the voltage by 90 deg which tends to compensate for the lagging current of the load, and by selecting a suitably rated capacitor it is possible to obtain an optimum improvement of the line power factor. The reduction in total line current will reduce the copper losses of the system and to some extent reduce the line voltage drop. Indeed, if a newly-erected overhead line transmission system could rely on a power factor of near unity, a great saving in capital outlay on plant could be made. Further, the reduced "wattless" power carried by the overhead line will allow more active energy to be carried by the line before it reaches its maximum rated thermal capacity; this is most valuable since it may well allow the expensive work of grid reinforcement to be deferred for several years.

To illustrate briefly the effect of the shunt application consider the system shown in Fig. 1.

As a close approximation, the voltage drop on such a line is given by:—

$$\text{Voltage drop} = \frac{\text{kW}\,(\text{R}\cos\phi + \text{X}\sin\phi)}{\text{kV}\cos\phi}$$

If voltage drop is limited to 5 per cent, then by transposition and substitution of the line data the maximum load that can be fed is:—

$$\frac{5}{100} \times \frac{33{,}000 \times 33}{(6 + 7{\cdot}5 \times 0{\cdot}62)} = 5{,}120 \text{ kW}$$ and line current 106 A.

If now a capacitor is installed to correct the p.f. of the load to unity, the load that can be supplied becomes

$$\frac{5 \times 33{,}000 \times 33}{100 \times (6 + 0)} = 9{,}075 \text{ kW}$$ and line current 159 A.

If the load in this latter case had remained at 5,120 kW, the line current would be approximately 90 A. Thus for the given load and voltage drop, the current has been reduced by about 16 A or 15 per cent. When only one load is to be supplied then the best position for the shunt capacitor is as near the load as possible. With many loads the capacitors should be placed at one or more selected points on the line which will allow the capacitors to operate to the best effect.

The Series Capacitor

The series capacitor, through which the line current passes, causes an increase at the point of application in the voltage of the line; this effect is of great benefit on lines where the voltage drop is serious. By virtue of the

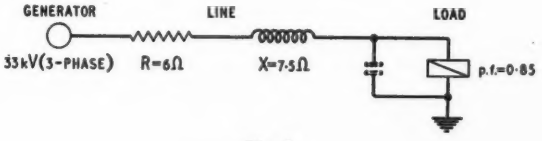


Fig. 1

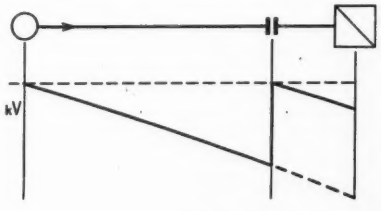


Fig. 2

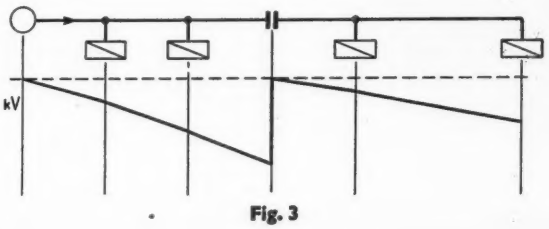


Fig. 3

greatly improved voltage stability that can be achieved on lines with low power factor, the large voltage fluctuations experienced with load variation can be eliminated, and this will enable less extravagant transformer tap-changing equipment or other voltage regulators to be selected.

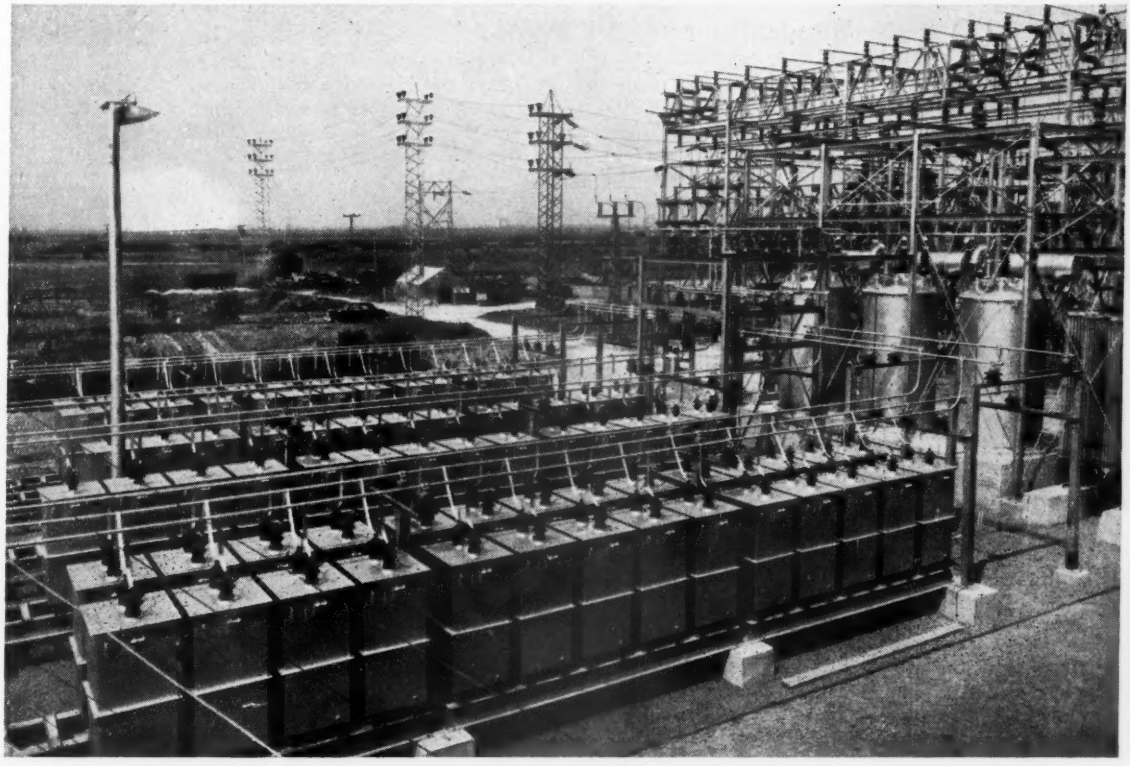
There is no simple way to describe the operation of the series capacitor; with a given load to be supplied, the introduction of a series capacitor produces an increase of voltage and this voltage increase results in a decrease in current which, in turn, reduces line losses and further reduces the voltage drop. Graphically, the effect can be shown in Fig. 2 for a line with a single load, while Fig. 3 demonstrates that for a line supplying several loads. When there is a single terminal load the optimum position for the capacitor is at the receiving end; with several load connections the best point of application is where the voltage drop is about $\frac{1}{2}$ to $\frac{1}{3}$ the total drop. In both diagrams the voltage after the capacitor is shown as raised approximately to the supply voltage. Although it is perfectly feasible to raise the voltage, by means of the capacitor, to a value greater than the supply voltage, the probability of a harmful rise in voltage between no load and full load and the problems of voltage stability that arise militate against such a practice.

Comparison of Shunt and Series

When arranged in shunt the capacitor will give the best overall improvement of the power factor and hence is most effective in reducing the total current and copper losses. Since the reactive volt-amps generated are not related to the load, means must be provided to switch some reactive kVA on and off the system as required in order to compensate for load variations. As has been stated, the shunt capacitor should preferably be placed as near the load point or points as possible. This introduces the problem that where shunt capacitors are installed in remote and unattended substations some form of automatic switching control is essential. While this is by no means an insuperable obstacle, suitable automatic equipment would add appreciably to the capital outlay.

The series-connected capacitor by comparison, on lines with a low power factor, gives the best improvement in the voltage regulation of the system. The series capacitors must, of course, be insulated above earth, but since the reactive volt-amps generated vary according to the load no special switchgear (as for shunt capacitors) is required. The voltage improvement caused by the shunt capacitor is related principally to the reactance of the line, whilst that obtained with the series capacitor depends mainly on the reactance of the load. In comparing these effects it must be remembered that as the load varies the series capacitor gives continuous automatic voltage regulation; the shunt capacitor gives only a fixed reduction in the voltage drop. On the other hand, the shunt installation offers a greater reduction in line current compared with series capacitors.

All power capacitors must be protected against voltage surges, fault currents, harmonic disturbances and the like. Many devices have been produced for this purpose, though all depend primarily on a spark gap and damping resistor. Since capacitors can withstand a considerable voltage overload for short periods, protective devices are usually arranged to operate when the voltage has risen to between 250 per cent and 290 per cent of the rated voltage. The speed of operation of protection equipment is important and some new systems have been devised that can extinguish the arc in the gap within about $\frac{1}{4}$ cycle. In larger installations where capacitors are arranged in banks, both in series and in parallel, it is advantageous as



Shunt-connected capacitors totalling 20 MVAr output at 10·3 kV (B.I.C.C.)

an additional precaution to arrange the units of each phase in the form of a bridge with a current transformer connected between equipotential points to supervise the bank.

Economic Considerations

Power capacitors have already proved themselves to be economically sound investments. There is in fact no question that they are, electrically speaking, beneficial in the vast majority of cases to the efficiency of transmission systems using overhead lines. The real problem is that of economics, both material and financial. Financially, the cost of the capacitor plant and its maintenance must be compared with the savings that accrue from the improved efficiency. Materially, the balance between the increased useful power that can be made available and the present shortage of supply must be considered.

On the question of cost it is possible to calculate with reasonable accuracy the amount of kVAr that can economically be installed. For shunt capacitors the optimum value of the corrected power factor is determined by the cost of generation, the cost of copper losses and the capital cost of installing capacitors. Of these parameters the cost of generation can be determined and the capital cost of installation of capacitors can be estimated with some precision; the value of energy losses, however, can only be obtained in the form of an average figure which depends on the average load on the system, but a sufficiently precise optimum value of the new power factor can be deduced.

The most economical value of the power factor, as corrected by shunt capacitors, is given by:—

$$\text{Tan } \phi = \frac{k}{20\ m.n.}$$ where ϕ is the corrected power factor, k is the annual charge for interest and capital repayment on 1 MVAr of capacitors per MW of the load, m is the annual cost per kW of copper losses, and n is copper loss at unity power factor expressed as a percentage of the load.

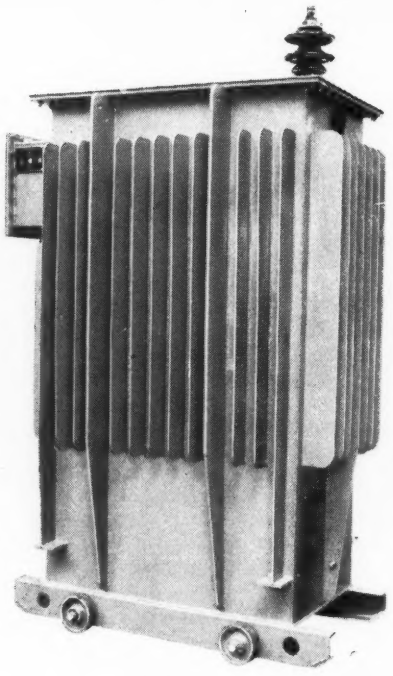
If the average figures for Great Britain are used to determine these three variables, then tan ϕ is approximately $\frac{300}{20 \times 9{\cdot}8 \times 4\frac{1}{2}}$. Whence cos $\phi = 0{\cdot}95$.

It is curious to note that this optimum p.f. for a transmission line is independent of the original value; in general this equation will show the economical p.f. to be within the range of 0·91 to 0·96. Further improvement whilst benefiting the line would involve a disproportionate expense. A similar evaluation will determine the optimum installation of series capacitors.

Conclusions

The power capacitor is most suitable and effective as a means of reducing energy losses and voltage drop on the overhead lines of a transmission system, where both load and line consume reactive power. If the system is operating, as do most of the distribution lines in Great Britain, with a power factor of 0·9 or better and a voltage drop which is at no point worse than 5 per cent, then there is but small advantage to be obtained by the installation of capacitors, but the increasing number of capacitor installations on overhead transmission lines where original operating conditions were poor proves their popularity and effectiveness.

Frequently, poor power factor or large voltage drop at a load point is of a temporary nature, such as when a small local generating station is shut down for repairs or policy and the load must then be supplied from some distance; in these circumstances a mobile capacitor bank that could be set up as a temporary measure would be advantageous and may well prove practicable in the not too distant future. Generally speaking, however, it would appear that in this country the best policy is to continue the tariffs and penalties to encourage the consumers, rather than the supply authorities, to improve still further their own power factors whereby the overhead distribution of electrical energy will be rendered still more effective.



333 kVAr, 3·81 kV single-phase 50 c/s capacitor (Johnson & Phillips, Ltd.)

British Electrical Conference in Brussels

THE first overseas registrations for the 1958 British Electrical Conference to be held in the Exhibition Auditorium at Brussels on 16th and 17th May next have been received and there has been a good response from the United Kingdom. Those proposing to attend the Conference but who have not yet registered are asked to do so without delay, particularly if they require the reservation of hotel accommodation. Full details of the Conference, with registration forms and hotel booking forms, are obtainable on request from the Organising Secretary, 1958 British Electrical Conference, 36, Kingsway, London, W.C.2.

Papers are to be read at the Conference by Sir Gordon Radley, director-general of the Post Office, on "Communication Between Nations and Peoples," and by Sir John Cockcroft, director, Atomic Energy Research Establishment, Harwell, on "Nuclear Energy, the Power of the Future."

The president of the Conference will be Sir Vincent de Ferranti, and a number of leading personalities in the electrical world have agreed to serve as vice-presidents.

TECHNIQUE OF BOILER CONTROL

Recent Trends in Automatic Equipment and Instrumentation for Power Plants

By R. E. J. PUTMAN, A.M.I.Mech.E.

UNTIL just after the end of the last war, the automatic control of power station boiler plant was a comparatively rudimentary science chiefly because the plant itself was simple and little improvement in the cycle efficiency could be expected from the more complicated control loops which we now accept as normal on modern high efficiency boiler plant. Pulverised-coal-fired boilers were the exception rather than the rule and the automatic control of stoker-fired boilers, which were then in the majority, usually consisted of a master controller which regulated the stoker speed over a range of about 3 : 1 and adjusted the air flow with a parallel signal to suit the rate of coal feed. Various devices were available to compensate for changes in fuel/air ratio due to variations in coal quality or fire bed thickness and cams were frequently incorporated in the equipment to allow for any non-linear characteristics in damper or speed regulating devices.

The most sophisticated principle for the control of combustion at that time was the steam/air flow ratio principle, developed by a major American instrument company before the war and still of great importance to-day despite the advent of flue gas analysers of various types.

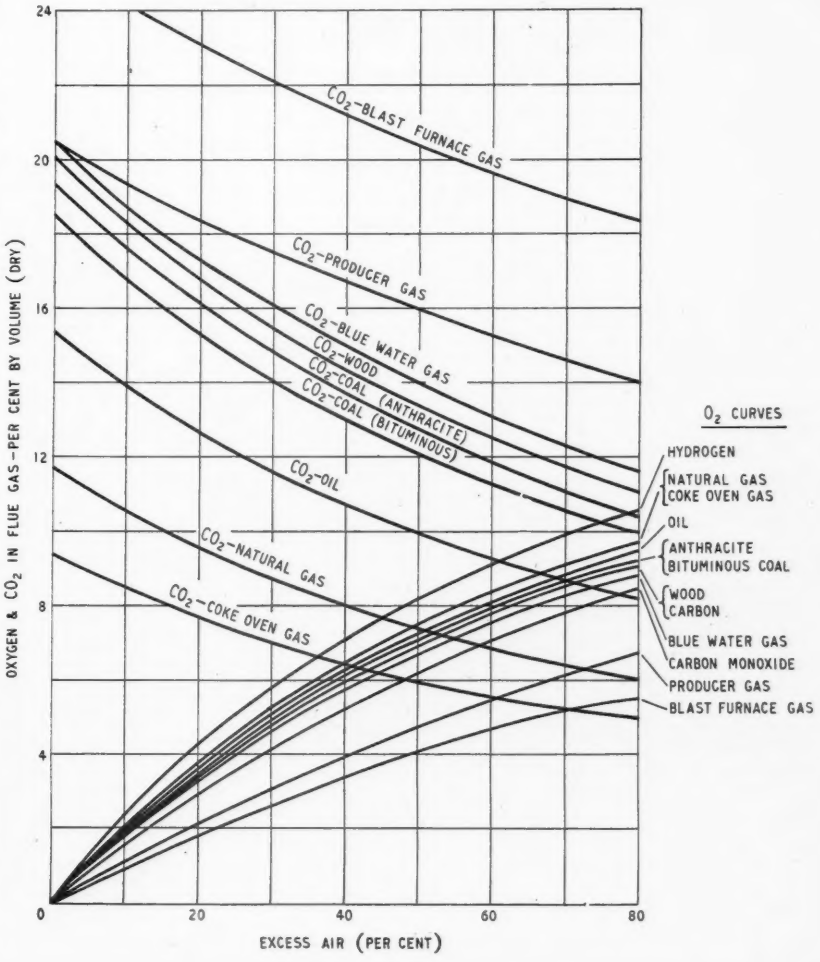
Since the war greater interest has been shown throughout the world in the need for fuel economy. At the same time, the design of boiler plant has become more complex in the quest for ever greater efficiencies and the general increase in unit size. This trend towards greater plant complexity and more arduous steam pressure and temperature conditions has meant that some of the most recent power station boilers cannot be operated safely unless the automatic control equipment is in good working order throughout.

The almost exclusive adoption of unit operation for boilers and turbines has also demanded changes in the presentation of instrumentation and control equipment. This and the increase in unit size requires a more highly qualified operator to run the plant than hitherto and the cost and scarcity of such men has resulted in an increase in the amount of equipment in the care of one operator. There is thus a strong pressure towards centralised control layouts and a consequent need to reduce the size of instruments and panels to a point where one man can handle and scan several units without fatigue.

This tendency towards centralised control rooms (which are essential in the case of outdoor and semi-outdoor stations) has brought in its wake a renewed interest in the electrical transmission and control of physical conditions and already several comprehensive power station control schemes are in operation in Canada and America using modern electronic control equipment and incorporating interacting features with regard to multi-element control loops which have in some cases been designed with great precision.

In this country there have been three broad lines of

Relationship between oxygen, CO_2 and excess air (George Kent, Ltd.)



development of automatic power station control equipment. Generally, the various advances in equipment design and technique have been stimulated initially by changes in plant design, operating requirements or conditions. These developments are most clearly seen in the equipment itself, in its application and the design of control loops and in the presentation of the instruments and controls to the operator.

Application

The earliest control schemes consisted of the parallel control of fuel and air, the two being set simultaneously from the common master steam pressure regulator. Combustion chamber pressure control in such schemes was usually quite separate.

In the control of oil- or gas-fired boilers series control was often adopted whereby only the air was controlled from the master, the fuel flow being adjusted by a separate controller in relation to the air flow. The control of combustion chamber pressure was again a completely separate loop. The series system was also used on boilers where the steam/air flow ratio control principle had been adopted, but while it is in general a more accurate method of control than the parallel system, when applied to large plants, the time lags on load changes are frequently so considerable that serious errors in air/fuel ratio and combustion chamber pressure can occur, resulting in a general loss of efficiency and the emission of dust and smoke into the boiler house and surrounding neighbourhood. With gas-fired boilers and to a lesser extent pulverised-coal-fired boilers any tendency towards a rich mixture in the furnace can be highly dangerous and errors in air/fuel ratio simply cannot be tolerated on load changes if due to system time lags.

To avoid this the parallel/series system was introduced and it is here that, what was in fact a simple computer, was first used in the control of power station boiler plant. In this arrangement one master steam pressure controller adjusts simultaneously the rate of fuel feed and the position of the forced and often the induced draught dampers as well, the dampers then being trimmed by the steam/air or fuel/air ratio and combustion chamber pressure respectively to maintain optimum combustion conditions throughout. Thus was eliminated the delay previously experienced with the simple series system of control between adjusting the rate of one variable and the corresponding adjustment to the rate of the other variable.

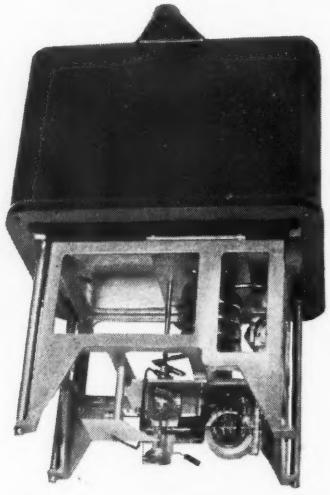
The parallel/series control scheme may also be considered as a two-element control system so far as the dampers are concerned since they are regulated not only from steam pressure but also from air/fuel ratio or combustion chamber pressure as the case may be. This trend in multi-element control has been extended considerably during the last few years, the most frequently quoted example being the three-element control of boiler feed water flow, but four- and even five-element control loops are now adopted where greater precision of control is required.

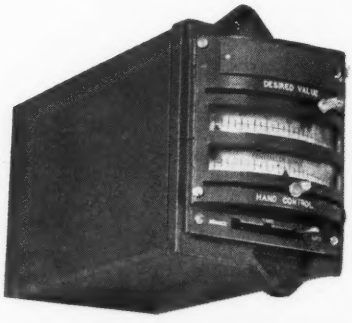
Three-element feed water control schemes may take several forms, but in almost every case the steam flow and water flow are initially balanced against one another and their effect then trimmed by the drum water level controller. The main object of measuring steam and water flow in addition to drum level is to avoid the undesirable effects of the shrinking and swelling of the water in the drum on changes in load. There are, however, varying opinions as to whether the flow difference should be used to adjust the desired value of the level controller or used to bias the level controller output. Something can be gained from the latter method in greater accuracy of control, particularly if a permanent difference exists between steam and water flow, as, for instance, if the boiler is being blown down or if there is some inaccuracy between the two flow signals at certain loads, resulting in an offset in the controlled level.

Another important field for multi-element control is in the regulation of steam temperature at either superheater or reheater outlet. If temperature is to be controlled by a regulation of water flowing to an attemperator, it is often found necessary to measure and control the attemperator water flow, so as to avoid any changes in the boiler feed system affecting indirectly control of steam temperature.

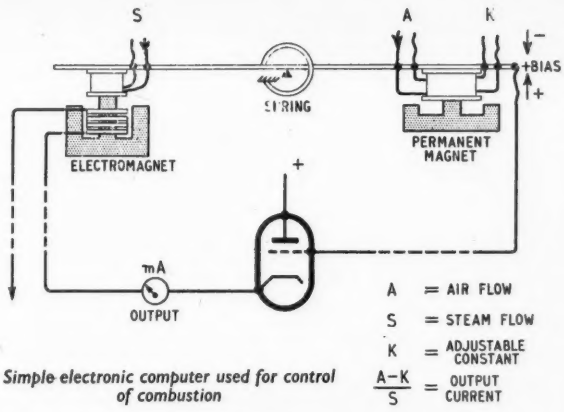
Again, with the higher temperatures which are now becoming common, ever greater accuracy of control is required and here steam flow, air flow and sometimes the gas temperatures at the superheater are all used in the control loop and arranged to position accurately, say, a recirculation gas damper and desuperheater valves in relation to these measured conditions, the steam temperature controller itself then being required only as a trimmer of the desired condition. The equation for such a system can be derived once the operating conditions at different loads are known by considering the superheater as a heat exchanger and quite simple and reliable devices are now available for solving these fairly complicated equations within the control loop.

The ever-increasing pressure and temperature for which modern power station plant is being designed and the





Bourdon tube fitted to an electronic pressure transmitter for high pressures. Below: A "Miniplaque"



Simple electronic computer used for control of combustion

adoption of the once-through boiler for these more arduous conditions demand ever-increasing precision in the performance of control equipment and we can therefore expect to see a greater use of multi-element controls for the regulation of combustion and of steam pressure and temperature. In a scheme recently published even the alternator frequency was linked into the control system so that some of the control schemes of the future will almost certainly include the regulation of the turbine as well as the boiler, to form an integrated scheme for the plant as a whole.

One of the principal trends in the control of combustion during the last few years has been a tendency on both large and small units to depart from the obvious air/fuel ratio control principle and to adopt (with increasing frequency) the steam/air flow ratio principle whereby the whole boiler is used as a calorimeter, the steam flow being regarded as a measure of the rate of fuel input to the boiler. This principle is almost obligatory for solid fuel-fired boilers not equipped with chain grate stokers and is very valuable for boilers fired with a combination of fuels of different types or with one fuel of widely varying quality. In particular it makes possible the precise control of combustion on boilers fired with heavy fuel oils or tars whose quality varies considerably and the flows of which are in any case difficult to measure. It may thus be considered a principle of universal application, but it has (of course) its limitations.

For instance, it is difficult to apply to boilers fired with gas of high calorific value where very close control of air/fuel ratio is required at all times and under all conditions. With the low percentages of excess air which these fuels require for efficient combustion there is a danger of this percentage being reduced on load changes, resulting in combustibles forming in the furnace and producing a dangerous condition. For purely gas-fired boilers therefore, the tendency is to retain the air/fuel ratio principle of combustion control since on steady loads the normal steam/air flow ratio control system is unable to adjust the air to suit the small changes in gas which the master controller introduces in response to variations in steam pressure.

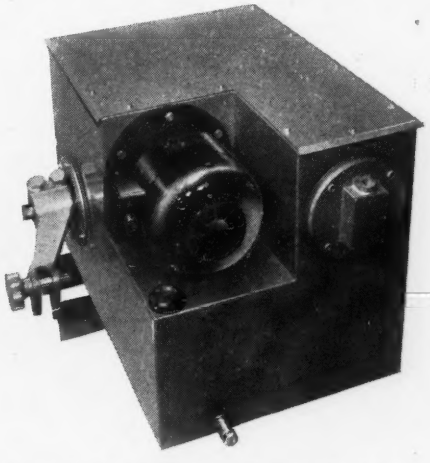
The current trend, which has been much publicised, is to use the percentage of oxygen in the flue gases as the parameter for combustion control. This is because the steam/air flow ratio does in fact vary slightly for different fuels whereas the percentage of oxygen is sensibly constant for a very wide range of fuels burnt at optimum efficiency. The oxygen analyser can therefore give better results than the steam/air flow ratio control method on mixed fuel-fired boilers and on all boilers where the quality of the fuel is varying continuously and by random amounts. While the instruments themselves are generally reliable, however, sampling, as with all flue gas analysers, presents problems and we are unlikely to see the oxygen analyser alone being used for combustion control for some years. Its application will normally be to trim the steam/air flow ratio, or else it will be used as an independent check on this ratio.

Equipment

At the beginning of the post-war era all of the well-established automatic control equipment manufacturers were using pneumatically operated equipment exclusively. Attempts had been made to use hydraulically operated equipment with some success, but for power station work there seemed to be a certain fire risk and the equipment was generally rather cumbersome in design and installation. Many of the features which had become commonplace with pneumatic equipment were not available and for all these reasons hydraulically operated equipment found little favour among power plant engineers except in Germany.

Electrically operated automatic control had also been tried but had been discarded chiefly because none of the devices exhibited servo characteristics and the operating mechanism soon suffered damage due to the continual and rapid reversing of the motors. This situation existed until about two years ago and manufacturers of pneumatic equipment showed considerable ingenuity in the design of devices such as those which allowed simple additions and subtractions to be made to the control signals including those which allowed two- or three-term control (proportional, integral and derivative action) to be introduced and various devices which allowed some variation to be made in the ratio between two or more signals.

Control panels were normally installed adjacent to the plant which they were controlling and contained very little electrical equipment. The plant was also operating at what are now considered to be low steam and feed water pressures and the danger of leakage from joints and pipes still present in the back of the panel was not considered too serious provided the electrical equipment was partitioned off from the rest of the panel. Nowadays, with the large amount of electrical equipment being used and the general increase in working pressures, this arrangement cannot be tolerated and modern specifications stipulate that all steam and water pressure, flow and level



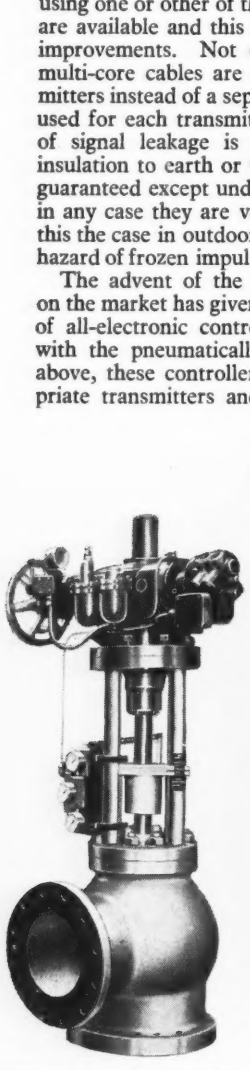
This electro-hydraulic positioner is a self-contained unit for operating valves and dampers requiring a torque of up to 4,000 lb/in

connections must now be removed completely from the control panel. As a result of this, transmitters are now almost universally employed to send signals between the tapping point on the plant and the control panel which, in a centralised installation, is now removed from the plant and installed in a central control room. The result is that the length of high-pressure impulse piping is reduced as is also the transmission lag in the control system, the possibility of leakage and the overall cost of installation as well.

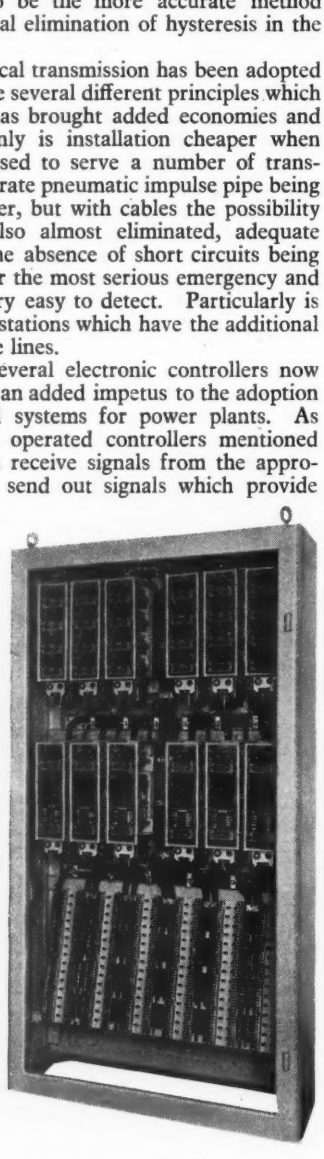
In this connection recent C.E.A. Specifications stipulate that an indicator should be provided locally on the transmitters and independent of the transmitted signal. Unless a local indicator is provided which is completely separate from the transmitter this will mean that all transmitters installed on C.E.A. plants must in future be of the deflection and not of the force-balance type which is normally considered to be the more accurate method owing to the almost total elimination of hysteresis in the measuring element.

In many cases electrical transmission has been adopted using one or other of the several different principles which are available and this has brought added economies and improvements. Not only is installation cheaper when multi-core cables are used to serve a number of transmitters instead of a separate pneumatic impulse pipe being used for each transmitter, but with cables the possibility of signal leakage is also almost eliminated, adequate insulation to earth or the absence of short circuits being guaranteed except under the most serious emergency and in any case they are very easy to detect. Particularly is this the case in outdoor stations which have the additional hazard of frozen impulse lines.

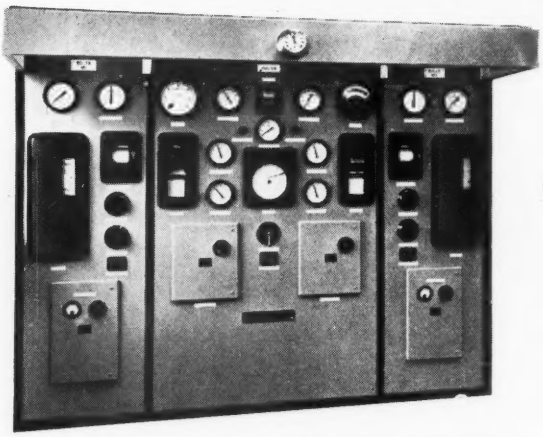
The advent of the several electronic controllers now on the market has given an added impetus to the adoption of all-electronic control systems for power plants. As with the pneumatically operated controllers mentioned above, these controllers receive signals from the appropriate transmitters and send out signals which provide



Rotary pneumatic servo-motor fitted to a control valve (James Gordon & Co., Ltd.)



Power unit trays grouped and housed in a cubicle for ease of installation and maintenance



Control panel for oil-fired boiler, including master steam pressure control and air/fuel ratio control

three-term action (proportional, integral and derivative). Thus, whereas until recently the electronic signals sent out by the transmitters had to be converted into compressed air signals in the control panel, and these were then used to regulate the servo-motors, moving valves and dampers, etc., now the whole of the control system can be electronic giving greater flexibility in arrangement, greater compactness and improved equipment availability. A good case can still be made out, however, for using hydraulic or pneumatically operated servo-motors for actually moving the controlling organs according to the magnitude of the signals received from the panel. An all-electrically operated servo-motor capable of exerting a high torque at a reasonable speed is not at present available.

With the ever-increasing adoption of electrically operated equipment has also come the ability to include devices which send out signals proportional to products or quotients of other signals. This is of particular importance in the measurement of true ratios and in the computation of units which are the product of two independent variables, e.g. B.Th.U.'s. The same electrical principle can also be used for obtaining square roots and squares and this enables precise compensation to be made to flows whose pressure, temperature and/or specific gravity vary. The same principle can also be used to obtain a measure of overall unit gross cycle heat rate by dividing the calories in the fuel fed to the boiler by the alternator output.

Another important trend is the use of the potentiometric recorder where a number of points have to be recorded on one chart with a high degree of precision, or where temperatures have to be related, as for instance on turbo-supervisory equipment. These facilities have an operational value and where a considerable number of points requires to be recorded as, for instance, superheater metal temperatures, a sizeable reduction in panel space also results. At the present time there are a number of physical conditions which can only be presented on a potentiometric recorder among them being oxygen in flue gas and oxygen in feed water concentration. Potentiometric recorders have proved extremely reliable in service and are now almost universally accepted even amongst the most conservative of power plant engineers and despite the fact that they incorporate electronic circuits.

Another advantage from the use of electronic equipment is the ease with which plug-in facilities can be pro-provided and the resulting ease of maintenance and hence

improvement in equipment and plant availability. The grouping of identical electronic components on trays in cubicles outside the main control panel also helps to make the back of this panel more accessible and again maintenance is assisted.

There is also a desirable tendency to avoid any high-voltage supply being brought into the panel, 110 V a.c. or 50 V d.c. being quite adequate for most purposes. This improves the safety to personnel working on the plant and in the control panel and also enables smaller cable to be used, particularly cable of the multi-core telephone type, so once again reducing installation costs and the ease with which circuits can be checked.

Presentation

Control panels installed adjacent to the plant were originally of very plain design, usually consisting of a simple cubicle on the front of which were mounted pressure gauges, flow meters, temperature indicators, etc., all connected directly to the various tapping points with which they were associated. Later, because of the large size of these instruments, a general increase in the number of points to be measured and the centralising of all motor controls on the panel, desks began to appear on the front of the cubicle and the major portion of the electrical equipment was mounted upon it.

With the adoption of the central control room the desks began to play a more prominent part in the panel layout until ultimately desk and panel became separate. The recorders were still large and they remained on the vertical panel installed usually against the wall of the control room while the remote and automatic controls and more important readings used for minute to minute operation were all mounted on the desk. This trend was accompanied by a desire to reduce the control panel in size and this set up a demand for smaller instruments in order that they should conform to the general proportion of the desk at which a man is required either to stand or in some cases to sit. The pneumatic control equipment manufacturers have gone to considerable lengths to provide pressure gauges and similar apparatus calibrated to suit the pneumatic signals sent out by their transmitters and of a size and appearance that will fit in with the rest of their remote and automatic control equipment.

While the pneumatic control equipment manufacturers have had to take the above steps, the manufacturer of electronically operated automatic control equipment had no such problem because a wide range of small milliammeters and millivoltmeters was already available and all that has been required is to calibrate the scales to suit the conditions measured by the appropriate transmitter.

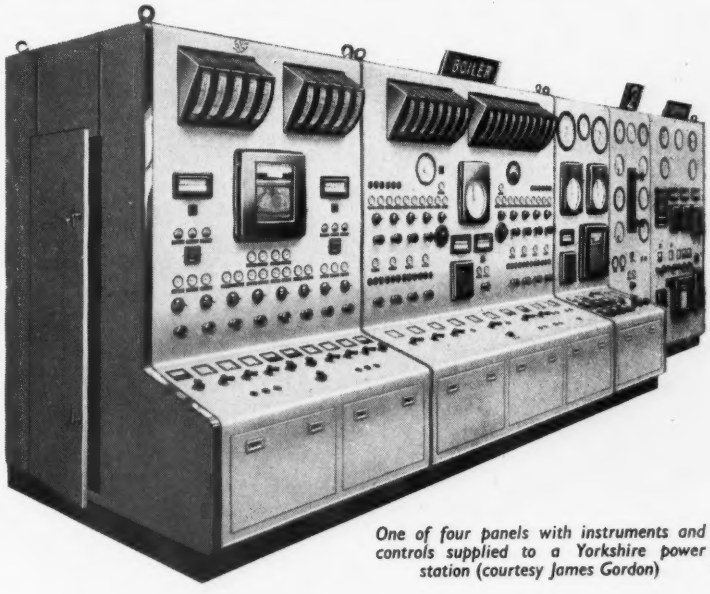
Inherently, the electrical measuring instrument is smaller than its pneumatic counterpart so that the adoption of electricity as the transmitting medium lends itself ideally to the miniature type of presentation and several miniature electrical recorders are also available which enable not only indication but also recorders to be mounted on the one small panel so avoiding the need for a separate recorder panel.

There is in some quarters a desire to add to the boiler control panel a mimic diagram of the plant, inserting the motor and valve controls in their respective positions in this diagram. With power plant arranged on the unit principle, however, it is felt that this diagram is of little value since the inter-relation of the plant is normally well understood by the operator before he takes over control of the unit. It is only in very complicated plant that a mimic diagram is really necessary or where several units of plant of different design are being controlled from one room and it is desired to emphasise these variations. The real disadvantage of the mimic diagram, however, is that the advantages arising out of miniaturisation are lost because the size of the panel has usually to be increased considerably to accommodate the diagram.

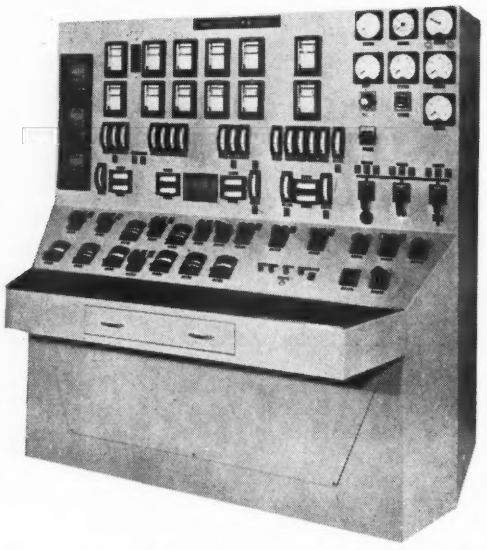
With the ever-increasing number of indicated points it is desirable to have some means of checking quickly and continuously the correctness or otherwise of the more important points, particularly those associated with automatic controllers. One method of doing this in the past, with circular indicators, was to group together the relevant gauges and arrange them so that, say, at full load, all the pointers were at 12 o'clock. At other loads, however, the pointers were at an angle to the vertical and not necessarily all at the same angle, so that this arrangement was not universal enough to be really satisfactory. An alternative method and one which is receiving considerable attention, is the line type plant monitor which utilises an error signal to operate a centre zero instrument, a number of which are arranged side by side. When the error to each instrument is zero, a straight line is formed, positive or negative errors being indicated by deviations of the appropriate indicators. The magnitude of the deviation for a given error can be adjusted to show the seriousness of the fault.

Another piece of equipment which has been introduced in some power stations as the result of the multiplicity of indicators which to-day's more complicated plants require for minute to minute operation, is the data reduction logger. Economies arise if the telemeters used to transmit the signals for the boiler control and instrumentation are also used to operate the logger.

Electrical typewriters are operated by a digital encoder which receives the transmitted signal and frequently alarm settings are also included in the system. While a timer whose period can be adjusted is used to determine the normal frequency of print-out, additional print-outs are



One of four panels with instruments and controls supplied to a Yorkshire power station (courtesy James Gordon)



Control panel for the fully electronic control of an oil-fired boiler. The equipment includes the master control of fuel oil pressure, control of i.d. fan from combustion chamber pressure, control of f.d. fan from steam/air flow ratio, three element feed water control and recirculation control of boiler feed pump

initiated whenever an alarm condition occurs. The number of recorders required on the installation can be substantially reduced if a logger is installed and again the size of the control panel is affected. One of the few operational disadvantages of a logger as opposed to the conventional recorder is that unless the frequency of print-out is very short, it is difficult to check the behaviour of the faulted condition immediately prior to the time the alarm occurred. For the routine recording of conditions which change only slowly, however, the logger may in the future come increasingly into use.

One of the other important trends in modern power plant instrumentation is the increasing use of television. Drum water level is the measurement receiving most attention and besides a standard camera and television receiver arrangement, specially designed and much simplified equipment has also been developed. In the pursuit of saving panel space multi-channel television has its attractions, one receiver being connected in turn to cameras installed in vital positions about the plant. In this way gauge sub-panels mounted beside turbine or boiler can be seen in the control room. Several installations for the relaying of furnace flame condition have also been demonstrated recently and there is no doubt the future will see them used to check ignition when operating burners remotely from the control room.

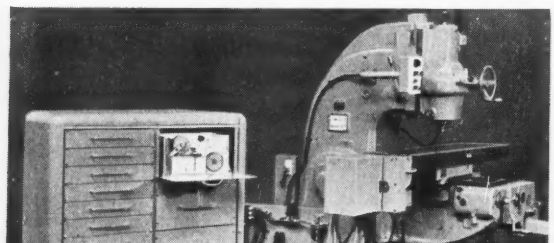
Conclusions

The twelve years since the war has produced many major developments in the design and application of equipment to the automatic control and instrumentation of power plant, not the least being the increasing use of electrical equipment and the acknowledged inevitability of present-day pneumatics being almost completely superseded by all-electrical controls on the high performance power plant of the next decade. The tendency towards central control rooms and the consequent need to reduce panel size all point in the same direction. Pneumatically operated control equipment will probably, however, continue to play an important part in the control and instrumentation of the smaller plants, particularly in general industrial installations.

Manufacturers of control apparatus have been quick to develop equipment to take full advantage of new trends in plant design and in general the user has welcomed the improved techniques and stimulated further developments in the ever harder struggle for greater efficiency.

Milling Machine Control

THE latest addition to the machines available with the numerical control system devised by E.M.I. Electronics, Ltd., Hayes, Middlesex, is the C.V.A.-Kearney & Trecker 2CES vertical milling machine. This machine tool has been specially modified to accept electronic control in two dimensions, and it has facilities for either linear or rotary machining; that is to say, the electronic control can be applied to the longitudinal traverse and either to cross traverse or rotary table, working with polar or cartesian co-ordinates as required.



C.V.A.-Kearney & Trecker milling machine fitted with E.M.I. numerical control

The longitudinal table movement and transverse saddle movement will position to within ±0·001in of the true position as instructed by the tape when traversing in either direction. The special detachable 16in diameter rotary table has final drive through a precision worm and wheel. As the table will be programmed to rotate in one direction only, the standard backlash eliminating feature did not have to be modified for this application. The rotary table will position to within ±2 min of arc of the true position as instructed by the tape.

In the E.M.I. numerical system, design data are prepared in the form of a table of dimensions of the part required at a series of specific points. These are encoded on punched paper tape and presented to the control unit, which deduces what movements should be made by the cutting tool and work-table to produce the correct profile and passes appropriate instructions to the servo controls of the machine. Once the paper tape has been fed into the control system the machine tool operates entirely automatically. The system therefore has all the advantages of a copying machine without the cost and labour of making templates, so that short runs or prototype parts can be produced as cheaply as longer runs. In addition, it is ideal for the production of master cams and templates for use on conventional copying machines.

VIEWS on the NEWS

By REFLECTOR

IT may be recalled that early last year proposals were afoot for instituting a memorial to Michael Faraday in the Newington Butts, Southwark, district of London in which he was born. At a meeting representing the Borough Council, the Faraday Society, the Royal Institution and a number of electrical organisations, various suggestions were put forward but up to date there has been no further development. A great deal of road reconstruction is now going on in the area, including the provision of traffic roundabouts, and it has been proposed that a memorial should be erected on one of these. It happens that a substation belonging to the London Transport Executive situated at the Elephant and Castle Underground Station has to be moved and the idea has been mooted that the substation should be re-sited on the centre of a roundabout and be furnished with glass panels so as to be open to the public view. If the substation were equipped with mercury-arc rectifiers it would certainly be attractive and the suggested lighting-up at night would be quite unnecessary. As presumably the bulk of the cost would be met by London Transport there should still be scope for the provision of the Faraday memorial scholarships, which were also suggested at the original meeting.

* * *

I have received one of the Central Electricity Authority's Christmas cards which, I think, merits special mention. Apart from the usual greetings the card presents a succinct history of the electricity supply industry during the last decade since the B.E.A. and Area Boards took it over. This account is enlivened by neat little devices symbolising the various units of the industry and concludes with a reference to the new Electricity Council and Central Electricity Generating Board which will control electricity supply from the beginning of next year. The chain of events is ingeniously depicted on the front of the card.

* * *

A direct hit by lightning, or contact with a high-voltage electric current, is generally fatal, and results in massive holes and tears in the body, especially in the brain and blood vessels. Nevertheless, most people apparently struck by lightning escape with no more than freakish damage to parts of their clothes and body, and it is perhaps surprising that those who survive do not suffer more permanent disabilities. According to the *British Medical Journal*, neither the cause of the extensive damage found in fatal cases nor the exact pathways followed by such currents as do traverse the body are yet finally settled. Some doctors believe that the energy goes mainly along blood vessels or nerves, others that the body is a low resistance structureless gel, so that there is a steady potential drop along the shortest line between the points of entry and exit of the current, with uniform potential fields around. Whatever the path taken it is the nervous system that bears the brunt of the current, and although the brain seems to be the most sensitive organ its functions are more often temporarily suspended than destroyed or permanently modified. In fact, a patient may recover without ill effects even where there has been an apparent suppression of all nervous activity lasting up to [illegible] hours. This underlines the importance of giving prolonged artificial respiration to those apparently dead from electric shock or lightning. But, as the *B.M.J.* points out, a careful physical examination is also necessary, since death may result from injuries received when a patient is thrown to the ground or against other hard objects.

* * *

Most people, I imagine, have experienced the difficulty of trying to read an electricity meter that has been hidden away in some dark and inaccessible position. Even the slot meters in hotel bedrooms are usually fixed so close to the floor that one has to go on hands and knees to discover how much current has been bequeathed by the previous occupant. Some of the students at the Essex Institute of Agriculture, however, are faced with the opposite problem. According to the *Scottish Sunday Express*, the slot meters in 40 of the bedrooms have been placed so high on the wall that stools are having to be made to enable students to reach them. This seems to me to be neither a cheap nor particularly safe solution, and before any bones are broken, I should think the education authorities would be well advised to have the meters re-installed at a more convenient height.

* * *

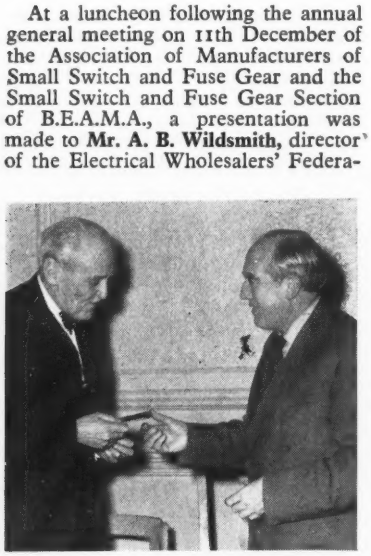
A form of vehicle which, at the time, seemed to offer some promise was described in the *Electrical Review* of 20th December, 1907. It was the battery-operated omnibus introduced by the London Electrobus Co. who had a fleet of eight of them running between Victoria and Liverpool Street stations. The Electrobus had a fully-laden weight of 7 tons (including 1½ tons of battery). In the latest type the drive was by two separate motors coupled by Morse chains to the rear wheels. The 400/500 Ah batteries were owned, charged and maintained by the two makers (Tudor and Gould) and a run of 40 miles (five round trips) was accomplished on one charge. Energy for charging was provided by the Westminster Electric Supply Corporation at 1d/kWh. The total running cost per bus-mile was 10d and the revenue 1s 1d. The *Review* said:—

> "The drivers, having no repairs to effect, are not grimy and greasy, like those of the petrol buses, and their vehicles are under perfect control, both electrical and mechanical brakes being provided. The spectacle with which Londoners have become so familiar, of a motor-bus (or buses) standing crippled and helpless at the roadside and blocking the traffic, has no application to the Electrobus, the simplicity and reliability of which are far above the standard of the petrol vehicle."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At a luncheon following the annual general meeting on 11th December of the Association of Manufacturers of Small Switch and Fuse Gear and the Small Switch and Fuse Gear Section of B.E.A.M.A., a presentation was made to **Mr. A. B. Wildsmith,** director of the Electrical Wholesalers' Federation, who is shortly retiring. Mr. R. Nicholls (Wm. Sanders & Co. (Wednesbury), Ltd.), the immediate past-chairman, in handing Mr. Wildsmith a cheque, spoke in appreciative terms of Mr. Wildsmith's work in the electrical industry and Mr. Wildsmith replied in felicitous terms. The opportunity was taken of presenting Mr. H. C. Babb, the secretary of the Association and Section, with a motor-car rug in recognition of his services and subsequently Mr. Nicholls himself was presented with a portable radio set and a handbag for his wife as tokens of his five years' chairmanship. The presentation was made by the new chairman, Mr. B. W. Pickup (Falk, Stadelmann & Co., Ltd.).



Mr. R. Nicholls (right) making the presentation to Mr. A. B. Wildsmith

Mr. R. G. Woodwark, D.S.C., M.A., A.M.I.E.E., who has contributed the article on capacitors (page 1103), was educated at Westminster Public School and St. John's College, Cambridge. After five years' war service as a radar officer in the R.N.V.R. he spent a short time with the British Iron and Steel Research Association before joining the staff of the Ministry of Defence, where he became a principal scientific officer. Since leaving the Ministry two years ago he has worked as a contracts engineer with the Overhead Transmission Line Department of the J. L. Eve Construction Co., Ltd.

Mr. R. G. Woodwark

Mr. C. H. Chambers, Associate I.E.E., has been appointed manager and a divisional director of Parkinson Cowan Instruments, a division of Parkinson & Cowan, Ltd. He has been associated for many years with Standard Telephones & Cables, Ltd.

The **Duke of Edinburgh** has consented to become patron of the Building Centre.

At the anniversary meeting of the Royal Society held on 30th November **Sir Cyril Hinshelwood** was re-elected president.

Mr. K. S. Ferguson, B.A., B.Sc., has been appointed education and training officer to Hoover, Ltd.

Tributes were paid to **Mr. J. A. Aked,** M.B.E., M.I.E.E., transmission engineer with the South of Scotland Electricity Board, at a complimentary dinner in his honour at Glasgow on 13th December when he retired. His colleagues presented him with a refrigerator. Mr. T. R. Warren, deputy chief engineer (distribution), presided. The presentation was made by Mr. J. Henderson, chief engineer of the Board, who spoke in felicitous terms of Mr. Aked's work in Scotland. Mr. Aked, in reply, thanked his colleagues for the gift. Miss A. Gray, a member of the Board's Glasgow staff, presented Mrs. Aked with a travelling clock.

Mr. Aked served his apprenticeship with the Yorkshire Electric Power Co., and after service in the 1914-18 war, joined the Clyde Valley Electrical Power Co. In 1929 he became transmission engineer with the Central Electricity Board (Central and South Scotland), and on nationalisation was appointed transmission engineer, C.E.A. South West Scotland Division, becoming transmission engineer with the South of Scotland Electricity Board in 1955. He was chairman of the South West Scotland Sub-Centre of the Institution of Electrical Engineers for 1955-56.

Mr. J. A. Aked being wished au revoir by Mr. J. Henderson. Left to right: Mr. T. R. Warren (deputy chief engineer (distribution)), Mrs. J. A. Aked, Miss A. Gray, Mr. J. A. Aked, Mrs. Warren, Mr. J. Henderson, Mrs. Henderson

Mr. W. G. Meyer, formerly an export executive of the Bata Shoe Co., has been appointed export manager of Birmingham Sound Reproducers, Ltd.

Mr. F. M. Ward, M.A.(Cantab.), general manager of Burco, Ltd., has been appointed a director of the company.

Mr. C. W. Nixon, B.Sc.(Eng.), A.M.I.E.E., A.M.Am.I.E.E., has been appointed sales manager of the Woden Transformer Co., Ltd. Mr. Nixon commenced his duties at the end of October last on leaving the service of British Insulated Callender's Cables, Ltd., with whom he had been a member of the sales organisation since the end of the war, his last appointment being regional manager for the West Indies and Latin America.

Mr. C. W. Nixon

Mr. N. R. Law, manager of the Nottingham branch in the Midland region of Philips Electrical, Ltd., recently celebrated the completion of twenty-five years' service with the company. The occasion was marked by a luncheon held in a London restaurant, and Mr. Law was presented by Mr. G. Hofman (managing director), on behalf of the company, with a cheque and a pair of binoculars. Other presentations were made on behalf of

colleagues on the staff. Mr. Law joined Philips as a representative with the lighting division. Five years later he was made a lamp sales supervisor in the London area, and in 1940 took up his present appointment at Nottingham.

To meet Britain's need for applied scientists Swansea University College hopes to double its complement of applied science students by 1962, said Sir Lewis Jones, chairman of the Council of the College, in proposing the toast of the **Institution of Electrical Engineers** at the annual dinner-dance of the West Wales (Swansea) Sub-Centre, held on Friday last at the Langland Bay Hotel, Swansea. Sir Lewis said that Britain was short of applied scientists and compared unfavourably in this respect with the United States and Russia. University graduates might lack practical knowledge and he appealed to members of the Institution to give graduates who were "raw" to industry a "helping hand."

Some of the guests at the annual dinner-dance of the West Wales (Swansea) Sub-Centre of the Institution of Electrical Engineers. In the front row above (left to right) are Mr. W. K. Brasher, Mrs. and Councillor P. P. Evans, Mrs. Goldup, Mr. and Mrs. I. G. Evans, Mr. T. E. Goldup (President) and Mrs. Brasher. Left: Mr. and Mrs. T. E. Goldup and Mr. and Mrs. I. G. Evans

Responding to the toast, the President of the Institution, Mr. T. E. Goldup, said that he was only too familiar with the problem of the shortage of applied scientists. New blood was constantly needed in the electrical industry on which every other industry in the world was dependent.

A heavy responsibility therefore rested on the shoulders of electrical engineers which they might not be able to bear without the recruitment of more applied scientists. He saw no other reason why the electrical industry should not continue to expand; the only thing that would halt progress was the acute shortage of applied scientists. The problem would take some time to solve, but he urged the industry to deal with the matter with a "sense of urgency." Mr. Goldup said that he hoped that other universities would follow the example set at Swansea and increase the number of applied science students.

The toast to the guests was proposed by Mr. J. L. Griffiths and responded to by Councillor P. P. Evans, Deputy Mayor of Swansea, and Mrs. J. F. Wright. The toast to the chairman, Mr. I. G. Evans, was proposed by Mr. G. R. T. Edwards.

Following upon the recent acquisition of a controlling interest in Bennis Combustion, Ltd., by James Hodgkinson (Salford), Ltd., **Mr. G. M. Mellor** has relinquished the appointment of joint managing director of Bennis Combustion, Ltd., in order to concentrate on the sales activities of the company. He will continue to serve as chairman. **Mr. B. W. Dawkins** has been appointed a joint managing director. The constitution of the board of Bennis Combustion, Ltd., is now as follows:—Messrs. G. M. Mellor, A.I.Mar.E. (chairman), F. Howarth (joint managing director), B. W. Dawkins (joint managing director), R. B. Page, A.M.I.Mech.E., J. S. A. Hodge, F.A.C.C.A., F.T.I.I., N. C. Crighton, A.M.I.Mech.E., M.Inst.F., and E. L. Hollinshead. Messrs. Hodge, Crighton and Hollinshead are also directors of James Hodgkinson (Salford), Ltd.

Mr. A. Rose has joined William Whiteley, Ltd., as assistant buyer of the Radio and Television Department. He has been for nine years branch manager of J. & F. Stone, Ltd.

At the annual general meeting of the Junior Institution of Engineers on 29th November **Mr. P. Cameron** was elected chairman.

Ranco, Ltd., announces the appointment of **Mr. H. J. Cadoux** as manager of its new research and development laboratories at North Berwick. A graduate in engineering science of Oxford University, Mr. Cadoux served a graduate apprenticeship with the British Thomson-Houston Co., Ltd., at Rugby, after which he spent six years on the staff of the Motor Engineering Department of that company. In 1954 he joined Crompton Parkinson, Ltd., as chief electrical design engineer.

Major C. Collaro has been appointed chairman of Camp Bird Industries, Ltd.

Mr. N. C. Lake has been appointed a director and deputy managing director of Head Wrightson & Co., Ltd. He will be responsible for the co-ordination of the group sales to the iron and steel industry. Mr. Lake was formerly managing director of the Head Wrightson Machine Co., Ltd. **Mr. D. Dodds-Parker,** M.P., has joined the board of the Head Wrightson Export Co., Ltd.

Mr. A. Neville is joining the Head Wrightson Export Co., Ltd., on 1st January as manager—Europe. Mr. Neville is at present in the International Department of the British Iron and Steel Federation.

Mr. J. J. Lesser, manager of the Regency District of the London Electricity Board, is retiring at the end of the year after forty-seven years' service in the electricity supply industry. After education at the East London Technical College and the London School of Economics, Mr. Lesser joined the industry in 1910. He became a member of the commercial staff of the City of London Electric Lighting Co. In the first world war he joined the Royal Artillery and served in Greece for 3½ years. Upon his return to the company he read for the Bar and was called at Gray's Inn in 1922. Subsequently he became sales manager of the company (in 1933), holding this post until nationalisation when he was appointed commercial officer of the former North West Sub-Area of the London Electricity Board. In 1955 he became

Mr. J. J. Lesser

Front row (left to right): Messrs. R. T. O. Freeth, E. B. Sawyer, D. Bellamy, J. I. Bernard and A. D. S. Atkinson. Back row: Messrs. J. W. Howell (Leeds), R. N. Smith (Glasgow), J. F. Roper, R. J. Fothergill (Newcastle-upon-Tyne), A. C. Holden (Birmingham) and A. D. Charters

manager of the Board's St. Marylebone/St. Pancras (now Regency) District.

During his time with the City of London Company he was instrumental in the development of electric convection heating largely as a means of improving the heating load factor. A two-rate day and night tariff was introduced and by persistent effort the public's innate conservatism was broken down and progress became comparatively rapid.

Mr. Lesser, who was elected an associate of the Institute of Heating and Ventilating Engineers and was for many years an associate member of the Chartered Institute of Secretaries, has served on many supply industry committees and sub-committees and was chairman of the Greater London Committee of the British Electrical Development Association and of its sub-committee on welding; he was a member of the E.D.A. Council in 1944-45.

Mr. L. Coope

The Liverpool Electric Cable Co., Ltd., has appointed **Mr. L. Coope** as sales manager from 1st January. **Mr. B. Keywood,** the present sales manager, has reached retiring age but remains with the company in a new assignment.

Following the coming into operation of the Electricity Act, 1957, **Mr. D. Cleghorn Thomson** will be relinquishing his appointment as director of welfare to the Central Electricity Authority as from 31st December, 1957, on terms mutually agreed.

A meeting of the area engineers of the **British Lighting Council** held in London recently gave Mr. D. Bellamy, O.B.E., D.L., chairman of the Management Committee of the Council, and Mr. J. I. Bernard, M.I.E.E., director and secretary of the British Electrical Development Association, an opportunity to meet the staff, when the accompanying photograph was taken.

Kennedy & Donkin are taking into partnership **Mr. C. M. Mitchell,** M.A. (Cantab.), A.M.I.E.E., and **Mr. J. G. Wiltshire,** B.A.(Cantab.), A.M.I.C.E., from 1st January.

The National Inspection Council for Electrical Installation Contracting has appointed **Mr. P. G. Wallis** as assistant technical officer, a full-time appointment, with effect from 1st January. Since the inception of the Council Mr. Wallis has assisted in a part-time capacity as adviser. He is well known within the electrical contracting industry, having been connected with G. E. Wallis & Sons, Ltd., and G. E. Wallis & Sons (Electrical), Ltd., of Ashford and Maidstone, for nearly forty years. He is also a past-president of the Electrical Contractors' Association.

Mr. W. F. B. Baker, D.F.H., A.M.I.E.E., has resigned his position as director and technical manager of Solenoids & Regulators, Ltd., and has joined the board of P. H. Jackson & Co., Ltd., Birmingham, who have been for many years Midlands engineers for the Telegraph Condenser Co., Ltd., and have recently been appointed technical representatives and distributors throughout the Midlands for "Rodene" timers and the Robinson range of relays and other components for automatic control.

The annual general meeting and luncheon of the Birmingham and District Branch of the **Electrical Industries Benevolent Association** was held at the Imperial Hotel, Birmingham, on 6th December. Mr. F. C. Barford (B.T.H. Co.) was elected chairman for the coming year on the resignation of Mr. F. A. Bartlam. The total amount raised from the collection taken was £41 10s.

The annual apprentice prize-giving of **Hoover, Ltd.,** was held on 11th December at the company's training school at Perivale, Middlesex. The proceedings were for apprentices at the company's group of factories in Southern England and for the apprentices at the Scottish factory. The Welsh group of Hoover factories centred at Merthyr Tydfil will, this year, have its own prize-giving at Merthyr. Mr. K. Adam, Controller of Programmes, B.B.C. Television, addressed the meeting on "Work, Leisure and Television."

The National Coal Board has appointed **Mr. K. L. Stretch,** M.A. (Cantab.), LL.B.(Lond.), A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E, as director of its Central Engineering Establishment at Bretby, South Derbyshire. Mr. Stretch has been acting director since the death of Mr. L. H. Daniel.

After graduation at King's College, Cambridge, in 1939, Mr. Stretch started a college apprenticeship with Mather & Platt, Ltd., in Manchester. During the war he served in the Royal Artillery and the Royal Electrical and Mechanical Engineers and reached the rank of major. In 1946 he returned to Mather & Platt to complete his training and was then employed as a research engineer. In January, 1948, he joined Imperial Chemical Industries, Ltd., and was employed first as instrument manager, then deputy works manager at a chlorine works, and finally as a mechanical design engineer on salt production.

Mr. K. L. Stretch

Mr. Stretch joined the Industrial Group of the United Kingdom Atomic Energy Authority in 1954 as works manager at Calder Hall. He was responsible for recruiting and training the staff to operate the nuclear power station, for inspection during construction, and for commissioning and running the Calder Hall station. He joined the N.C.B. in September last as deputy director, Central Engineering Establishment.

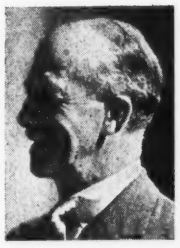
OBITUARY

Mr. Leo Falk, formerly chief designer to Transformers (Watford), Ltd., died on 6th December. He retired in 1954 having served the company since its inception. Mr. Falk was responsible for designing some of the largest arc furnace transformers in use to-day and played a major part in the development of the constant current regulator used for airfield lighting.

Mr. Frederick George Creed, the inventor of the Creed teleprinter system, died at Croydon on 11th December at the age of eighty-six. He was

born in Nova Scotia, Canada, and came to this county in the late 1890's. He perfected his teleprinter system in Scotland and in 1909 formed Creed & Co., Ltd., in Croydon, leaving the company in 1930.

Mr. C. G. Morley New.—We regret to report the death, on 10th December, of Mr. C. G. Morley New, C.B.E., M.I.E.E., who was an Electricity Commissioner from 1935 to 1948. Mr. Morley New was born in Cardiff in 1879 and underwent training in the Leeds Electricity Department. He joined the Cardiff Electricity Department in 1902 and was subsequently deputy electrical engineer (1907-20) and city electrical engineer and manager, including tramways (1920-35). He was then a member of the Electricity Commission until vesting day when he became a member of the South Eastern Electricity Board, retiring from that position in 1955. He was president of the former Incorporated Municipal Electrical Association in 1931-32 and he had served on the Councils of the British Electrical Development Association and the Electrical Research Association. He was chairman of the I.E.E. Western Centre in 1927-28 and a member of the I.E.E. Council from 1933 to 1936. Mr. Morley New was also a member of the Government Goodwill Mission to Egypt in 1946. His son, Mr. C. Morley New, M.I.E.E., is transmission engineer, South Wales Division, C.E.A.



The late Mr. C. G. Morley New

Mr. G. P. Haskell.—We report with regret the death, on 12th December, of Mr. George Percy Haskell, who was a member of the staff of the *Electrical Review* from 1894 until his retirement in 1946. For many years he was in charge of the advertisement department and he was a director during the latter part of his service with this journal.

Mr. P. B. Hall.—The death occurred on 12th December of Mr. Percy Burnett Hall, M.I.E.E., who, before his retirement some years ago, was sole agent for Elliott Brothers (London), Ltd., for the Midlands and Wales, and who, before 1933, was assistant managing director of Erskine, Heap & Co., Ltd.

Mr. W. B. H. Gallwey, chairman of the British Acheson Electrodes, Ltd., and chairman and managing director of Union Carbide, Ltd., died suddenly at his home at Cobham, Surrey, on 14th December.

Mr. A. R. Shapley.—The death occurred recently of Mr. A. R. Shapley, a former deputy city electrical engineer of Bath. Mr. Shapley was with the undertaking for forty-seven years, and on retiring from the position of deputy city electrical engineer after the war was retained by the City Council in a consultative capacity for three years.

Mr. W. Redmayne, former chief assistant engineer with the Rotherham Corporation electricity undertaking, died on 7th December at the age of seventy-one. He joined the undertaking in 1911 as meter superintendent, later becoming distribution superintendent, and in 1934, chief assistant engineer, from which position he retired in 1947. He had contributed a number of articles to the *Electrical Review*, mainly on fault localisation.

Mr. J. J. Hambidge, chairman of the British Vacuum Cleaner & Engineering Co., Ltd., died suddenly on 9th December at the age of sixty-seven. Mr. Hambidge joined the company in 1911, was appointed a director in 1923 and general manager in 1928. He became joint managing director in 1936 and eventually succeeded Mr. H. Cecil Booth as chairman in 1952. He devoted the whole of his life to the "Goblin" organisation and travelled widely in the interests of the company, establishing companies in Canada, South Africa and New Zealand, and agencies throughout the world. A memorial service was held on 18th December at Leatherhead Parish Church.

The late Mr. J. J. Hambidge

I.E.E. Benevolent Fund

The President of the Institution of Electrical Engineers has made a personal appeal to members of the Institution on behalf of the Benevolent Fund. Mr. Goldup says that during the past year 116 grants totalling £9,833 have been made from the Fund and that the sixteen homes at "The Chesters" Estate are all occupied, apart from the accommodation of other beneficiaries through subscriptions to the Crossways Trust. But during recent years there has been no significant increase in subscriptions in spite of the increased membership of the Institution. Only 30 per cent of the 42,000 members subscribed last year and the receipts amounted to only 6s 7d per member. Mr. Goldup asks members to determine to raise £20,000 during the current year—about 10s per member. Of this sum £6,000 could be used to bring the Homes Fund up to the target figure of £50,000, while the remainder would permit more generous grants to be made.

E.T.U. Leaders' Statement

Mr. F. Foulkes, general president of the Electrical Trades Union, protested last week to Sir Ian Jacob, director-general of the B.B.C., against the way in which Mr. Woodrow Wyatt handled the subject of the E.T.U. elections in a television programme recently. In reply, Sir Ian Jacob offered Mr. Foulkes an opportunity of presenting his views on television. Mr. Foulkes made it a condition that he should be given 20 minutes and that he should not be interrogated, but Sir Ian Jacob would not agree to this.

In the meantime Mr. Foulkes and Mr. F. L. Haxell, the Union's secretary, both appeared in Independent Television programmes. Mr. Foulkes stated that the disputed ballot figures would be published to members in two or three weeks' time. He scouted the idea that members would be victimised for criticising the Executive Council although he admitted that "disciplinary action" was possible.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £185 5s 0d
Fire Refined 99·70%	ton £184 0s 0d
Fire Refined 99·50%	ton £183 0s 0d
COPPER Tubes ..	lb 1s 9½d
Sheet	ton £203 5s 0d
H.C. wire and strip ..	ton £225 15s 0d
LEAD, English ..	ton £72 5s 0d
Foreign	ton £71 0s 0d
MERCURY	flask £69 0s 0d
TIN, block (English) ..	ton £732 5s 0d
ZINC, G.O.B. Foreign	ton £62 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 5½d
Sheet	ton —
Wire	lb 2s 3½d
PHOSPHOR BRONZE Wire	lb 3s 7½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 24½d—24½d

CONTRACT PRICE FORMULAE

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 13th December is deemed to be 186s 6d.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 13th December is 179·5. For turbo-generating and allied plant: Materials used in mechanical engineering industries 186·9, blast furnaces and iron and steel melting and rolling (40 and 41) 192·3. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 13th December) is 41½d per lb.

Financial Section

STOCKS and SHARES

HAVING been more or less becalmed for some weeks past, the Stock Exchange looks forward to some freshening of interest after the Christmas holiday. Hopes are based not only on seasonal considerations, but on the prospect that the launching of the British Petroleum Company's £41 million capital issue, which attracted applications for some £675 million stock, will release into normal investment channels some of the millions of money tied up in that operation. By the beginning of this week the gilt-edged market, assisted by the good November overseas trade figures, already appeared to be gathering some strength in anticipation of a broader demand at the start of next month, and industrial share prices were inclined to follow that lead.

Highs and Lows

As can be seen from the last columns in the accompanying tables, the great majority of electrical shares are ending the year (in correspondence with the general situation in the industrial market) at prices a little above their lowest, which were recorded in most cases in November, but much below the levels reached during the rise of the market in the first half of the year. Distinction is attached consequently to the few with current quotations nearer the highest than the lowest marks. Most of these owe their positions to the impression made by financial results and dividend declarations. This would account for the relatively good performance of such shares as Ward & Goldstone, Dewhurst & Partner, Holophane, Aerialite, S. Smith, Brook Motors and Burco, on most of which there was some increase in the dividend in addition to particularly good earnings figures. Others which have maintained their value better than the average are the shares of Parnall (Yate), De La Rue, Newman Industries and Desoutter Brothers (now ex-the scrip issue).

Richardsons Westgarth Issue

An improvement in the price of Richardsons Westgarth 5s shares from 14s 6d to 15s registered satisfaction with the directors' decision to meet the need for fresh capital through an issue of convertible unsecured loan stock. This form of security, coupling a fixed rate of interest with an option to convert later into the ordinary shares of the company concerned, has lately acquired a great deal of popularity. Richardsons Westgarth shareholders were told at the meeting in July that more money would be called for to supplement existing resources and retained profits in financing the programme of extensions and modernisation. Official consent has been obtained now for the raising of £3½ million cash, and also for a 100 per cent scrip issue. Details of the cash issue are to be announced soon, and the

Price Changes in

Company or Board	Nom. Value	Middle price 16th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	72	+½	3	3	4 3 3	80	70
Brit. Elec. 1974/77	100	68½	+½	3	3	4 7 6	78½	66
Brit. Elec. 1976/79	100	72	+½	3½	3½	4 17 3	81½	70
Brit. Elec. 1974/79	100	82½	+½	4½	4½	5 3 0	92½	79½
Overseas Electric Supply								
Calcutta Elec.	£1	18/-		6†	6·8†	7 11 0†	19/-	15/-
East African Power	£1	20/-		7	7½	7 10 0	21/-	19/-
Nigerian Elec.	£1	16/6		10	10	12 2 6	18/6	16/6
Perak Hydro-Elec.	£1	16/-		10	12½	15 12 6	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/6		17½	17½	8 6 9	12/-	9/9
Aerialite	1/-	6/3	+3d	48	51½	8 4 9	6/9	4/9
Allen, W. H.	£1	35/-		10	10	5 14 3	47/3	33/6
Anglo-Portuguese Tel.	£1	21/9		8	8	7 7 3	27/6	20/6
Aron Elec. Ord.	£1	55/-		15	15	5 9 0	60/-	53/6
Assoc. Elec. Ord.	£1	50/-	+1/3	15	15	6 0 0	73/-	48/9
Automatic Tel. & El.	£1	57/6		15	17	5 18 3	75/-	54/6
Babcock & Wilcox	£1	58/9	−6d	15	15	5 2 3	82/6	54/9
Bakelite	10/-	21/3		16	15	7 1 3	24/6	20/9
Baldwin, H. J.	2/-	3/9		20	20	10 13 3	5/-	3/9
Berry's Electric	5/-	6/-		—	10	8 6 9	6/6	5/6
British Aluminium	£1	41/3	−1/3	12	12	5 16 6	71/3	38/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	19/3	−3d	22½	25	6 9 9	25/-	17/-
B.I. Callender's	£1	40/9		12½	12½	6 2 9	55/-	39/6
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	21/9	19/-
British Tabulating	£1	41/9x.d.	+6d	9	10	4 15 9	56/3	37/6
British Thermostat	5/-	21/3		25	25	5 17 9	27/6	21/3
British Vac. Cleaner	5/-	5/-		15	10	10 0 0	8/-	5/-
Brook Motors	10/-	35/-x.d.	+1/3	25	25	7 2 9	37/6	30/-
Bulgin, A. F.	1/-	4/6	−3d	50	40*	8 17 9	5/6	4/-
Burco Dean	5/-	14/-	+3d	20	22½	8 0 9	14/-	8/9
Cable & Wireless: Ord.	5/-	9/9	−3d	10	10	5 2 6	12/6	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage "A" ...	£1	58/9	−6d	17½	17½	5 19 3	68/9	55/9
Clarke Chapman	£1	135/-	−5/-	22½	27½	4 1 6	9	5⅝
Cole, E. K.	5/-	17/6		17½	17½	5 0 0	23/6	16/6
Cossor, A. C.	4/-	5/3		Nil	2½	2 7 6	7/3	5/-
Crabtree	10/-	24/3		20	20	8 5 0	26/-	23/3
Crompton Parkinson Ord. ...	5/-	15/-x.d.	+3d	16	16	5 6 9	17/9	14/-
De La Rue	5/-	22/3		30	35	7 17 3	24/9	16/3
Decca "A"	4/-	25/9	−6d	43¾	43¾	6 16 0	32/3	22/-
Desoutter	5/-	15/6x.c.		30	32½	5 4 9*	17/9	13/9
Dewhurst	2/-	7/6	+6d	16½	20	5 6 9	7/9	5/9
Dictograph Tel.	2/-	5/9		20	20*	6 19 3	6/3	5/3
Dubilier Condenser	1/-	3/3		30	30	—	5/3	3/-
Duport	5/-	18/3		25	25	6 17 0	21/-	17/-
E.M.I.	10/-	29/-	+3d	15	15	5 3 6	36/-	23/9
Electrical Components	5/-	7/3		25	12½*	8 12 6	8/-	6/6
Elec. Construction	£1	23/9		8½	8½	7 3 3	27/6	21/9
Elliott-Automation	5/-	12/6		—	10‡	4 0 0	12/6	10/3
Enfield Cable Ord.	£1	12/9	−6d	Nil	Nil	Nil	21/6	12/3
English Electric	£1	50/-	+1/3	12½	14	5 12 0	65/-	47/6
English Electric 3½% Pref. ...	£1	12/3		3¾	3½	6 2 6	14/3	11/3
Ericsson Tel.	5/-	19/-		20†	22‡	2 18 0*†	25/-	17/-
Ever Ready	5/-	14/-	−9d	35	37½	6 14 0*	20/-	14/-
Falk Stadelmann	£1	36/3		17½	17½	9 13 0	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

necessary meetings are to be held on 8th January.

Burco Results

A final dividend of 15 per cent from Burco Dean brings the total for the twelve months ended in September to 22½ per cent, and so makes good the 2½ per cent cut of the previous year. Figures in the preliminary profits statement come well up to the expectations raised by the promising interim report issued in May. At £205,000 (after an increased tax charge of £246,000) the net profit is £78,000 better than last year's. Dividends involve the distribution of £70,000, leaving more than £130,000 to go back into the reserves. Having been well supported for some time past in anticipation of good results, the 5s shares were marked up further to 14s, at which level the yield works out at 8 per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 16th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	38/9		14	12½	6 9 0	58/9	38/9
G.E.C. 6½% Pref.	£1	20/6	−3d	6½	6½	6 6 9	23/6	19/6
General Cables	5/-	12/6		30	30	12 0 0	15/6	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	51/3	45/3
Hackbridge Holdings	5/-	11/9		30	20	8 10 3	21/9	11/3
Hackbridge & Hewittic	5/-	11/3		23	20	8 17 9	16/-	10/-
Head Wrightson	5/-	18/6		20	22½	—	24/3	16/6
Heatrae	2/-	4/9		15	15	6 6 6	4/9	4/-
Henley's	10/-	11/6	+6d	11½	11½	10 0 0	17/-	11/-
Helophane	5/-	13/-		30	37½	8 13 0*	15/9	10/3
Hoover	5/-	33/6		50	50	7 9 3	44/-	24/9
I.C.I.	£1	39/3	+3d	10	10	5 4 6	46/6	36/3
Intl. Combustion	5/-	21/-		20	22½	5 7 3	30/-	19/3
Johnson & Phillips	£1	18/9		15	10	10 13 3	34/6	18/9
Lancashire Dynamo	£1	33/9		11	11	6 10 3	45/9	33/6
Laurence, Scott	5/-	14/9		15	15	5 1 9	19/9	13/9
Lister, R. A.	£1	25/9		10	10	7 15 3	33/9	23/3
London Elec. Wire	£1	41/3		12½	12½	6 1 3	53/9	40/9
Lucas, J.	£1	28/9		7½	7½	5 4 3	36/6	27/6
Marconi Marine	£1	30/-		10	10	6 13 3	37/-	30/-
Marryat & Scott	2/-	10/6		30	35	6 13 3	13/-	8/-
Mather & Platt	£1	47/-	−6d	15	15	6 7 9	63/9	47/-
Metal Industries	£1	22/9		Nil	9	7 18 3	30/-	20/3
Midland Elec. Mfg.	£1	47/6		12½	12½	5 5 3	52/6	45/-
Morphy-Richards	4/-	15/-		50	20*	5 6 9	20/-	11/6
Murex	£1	58/3		20	20	6 17 3	79/6	58/3
Newman Ind.	2/-	2/9		10	10	7 5 6	2/11	2/1
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parnall (Yate)	5/-	7/6	+9d	12	12	8 0 0	8/9	5/9
Parsons, C. A.	£1	52/6		8½	7½*‡	—	71/3	45/-
Plessey	10/-	60/-	−2/6	30	30	5 0 0	86/3	60/-
Pye "A" Deferred	5/-	13/3		12½	12½	4 14 3	20/-	12/-
Reyrolle	£1	80/-		16½	17½	4 7 6	110/-	72/-
Rheostatic	4/-	7/9		18½	12½*	6 9 0	10/-	7/-
Richardsons Westgarth	5/-	15/-	+6d	16⅝	16⅝	5 11 0	20/-	13/6
Scottish Cables	4/-	14/3x.d.	+6d	27½	27½	7 14 6	19/3	13/3
Simon-Carves	5/-	23/9		28½	20*	4 4 3	36/3	23/9
Smith (England), S.	4/-	7/6x.c.	+6d	17½	20	5 6 9*	8/-	6/3
Southern Areas	£1	11/3		7½	7½	13 16 9	20/-	11/3
Strand Elec.	5/-	5/9	−6d	15	15	13 0 9	8/-	5/9
Sturtevant	5/-	18/3		15†	15†	4 2 3†	27/-	18/-
Sun Elec.	£1	47/6	+3/9	25	25	10 10 6	47/6	42/-
Switchgear & Cowans	5/-	9/6	−3d	25	25	13 3 3	15/6	9/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	13/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	41/3	35/-
T.C. & M.	£1	24/-		8½	8½	7 1 9	31/-	24/-
Telephone Mfg.	5/-	5/6		10	10	9 1 9	8/-	5/3
Telephone Rentals	5/-	10/3		12½	12½	6 2 0	12/6	9/6
Thompson (John)	5/-	25/-		25	25	5 0 0	37/-	23/6
Thorn Elec.	5/-	21/3		15	17½	4 2 3	26/3	16/3
Thornycroft	£1	27/6		12½	12½	9 1 9	37/6	21/3
Tube Investments	£1	53/3	−1/6	13⅓	15	5 12 9	70/-	51/3
Vactric	5/-	15/-	−2/6	17½	25	8 6 9	23/9	12/9
Veritys	5/-	6/9		12½	12½	9 5 3	9/3	6/9
Walsall Conduits	4/-	11/6		20	20	6 19 3	15/-	11/-
Ward & Goldstone	5/-	24/6		35	40	4 1 9*	29/-	18/6
Watford	2/-	6/-		25	25	8 6 9	6/9	5/9
Westinghouse	£1	32/6	+1/3	18	9‡*	5 10 9	41/3	28/9
West, Allen	5/-	10/3		15	15	—	13/6	9/6
Wolf Electric	5/-	9/-		20	20	5 11 0*	13/9	8/9

Vactric Interim

Having risen to over 18s during the early part of this month, Vactric 5s shares suffered a rather sharp reverse to about 15s after publication of the company's progress report covering the half-year ended in September. Group profits (before tax) in this period are stated to have been £165,000, against £275,000 for the same six months of the previous year and £531,000 for the full year ended last March. Turnover has risen substantially, but profits have been affected by several factors including increased costs and heavy initial expenses connected with the introduction of the company's new washing machine. The results are described as not unsatisfactory in all the circumstances, and taking into account the present trading outlook the directors are maintaining the interim dividend at 10 per cent. The total payment of 25 per cent for 1956–57 was covered fully three times over by the earnings of that year.

S. Smith & Sons

The 4s ordinary shares of S. Smith & Sons (England) are now quoted ex-the 100 per cent scrip issue. This involved the capitalisation of reserves to the extent of approximately £2·9 million, a sum roughly equal to the profits ploughed back into the business over the past three years. At last week's annual meeting Mr. Gordon-Smith connected this large scale of profit retentions with the recovery of earnings during the twelve months ended in July. After two years of reduced profits, the latest results were restored almost to the level of three years ago. The motor accessories division of the firm benefited only in the closing months from the revival in the car industry, and in general the chairman credits the improvement to the policy of diversification and expansion. Some further improvement in the current year's earnings is expected, although the uncertainties in the outlook are emphasised. Assuming a 10 per cent dividend on the present capital, the shares at 7s 6d are on a yield basis of a little under 5½ per cent.

Industrial Fuel Efficiency

Next year's Industrial Fuel Efficiency Exhibition will be held at Olympia, London, from 24th September to 3rd October. Inquiries should be sent to Provincial Exhibitions, Ltd., City Hall, Deansgate, Manchester, 3.

REPORTS and DIVIDENDS

Richardsons Westgarth & Co., Ltd., has made a preliminary announcement regarding the raising of new capital. The new money is to be raised by an issue of convertible unsecured loan stock, the amount for which the consent of the Capital Issues Committee has been obtained being £3,500,000. Terms and method of issue will be announced at an early date. The directors state that existing stockholders will be given preferential rights and it is also hoped to make it possible for staff and employees to subscribe. The consent of the Capital Issues Committee has also been obtained for a one-for-one scrip issue which will be effected by replacing the 5s stock units by 10s shares. A meeting will be held on 8th January to raise the authorised capital from £5 million to £10 million, effect the scrip issue, and adopt new articles.

Vactric, Ltd., has declared an interim dividend of 10 per cent (unchanged).

In announcing the interim dividend, the directors state that the net profit of the group for the half-year ended 28th September, after charging depreciation of £55,367, but before taxation, amounted to approximately £165,000 as compared with £275,000 in the corresponding period last year and £530,702 for the full year ended 30th March last. During the half-year under review there was a substantial increase in turnover. The reduction in profit is primarily attributable to the following causes:— Increased manufacturing costs and selling expenses which were absorbed by the company and not passed on to the consumer; heavy initial costs in establishing the manufacture and marketing of the new Vactric electric washing machine; serious loss of output in two of the group's factories, consequent on labour difficulties; and an increase in losses sustained by the Canadian subsidiary. In all the circumstances it is not considered that the results are unsatisfactory and having regard to the present trading indications the board feels justified in maintaining the interim dividend as last year.

S. Smith & Sons (England), Ltd.— The annual meeting was held on 11th December, Mr. R. Gordon-Smith (chairman and managing director) presiding. In the course of his review of the past year the chairman drew attention to the overall recovery in profits, and said that after two years of reduced profits they had now almost restored the level to that of three years ago. The improved results had largely been achieved through their policy of diversification to which he referred last year. Dealing with the various divisions, Mr. Gordon-Smith said that the industrial instrument division had had a record year, both as regards home and export sales. The production of industrial electrical instruments had been transferred from Cheltenham to Chronos Works, London, and as a result the output of this class of instrument had increased considerably. They were planning to provide this division with considerable additional productive capacity to meet the increasing demand. Kelvin & Hughes had had a satisfactory year and the present order book was slightly ahead of last year.

The Solartron Electronic Group, Ltd.—In his statement to shareholders covering the year ended 30th June last, Mr. J. E. Bolton (chairman and managing director) says that some of the highlights of the year were a fourfold increase in export orders over the previous year at £340,000, first N.A.T.O. orders for radar simulators, first order for the Solartron reading automaton, and many new instruments adopted as standard by the Services.

Sales were up by one-third as compared with the previous year and in the first three months of the current year they rose by 40 per cent. Mr. Bolton reviews new developments in the fields of instrumentation, electronics and processing equipment.

Burco Dean, Ltd., reports a group profit for the year ended 30th September last of £445,303, as compared with £286,461 for 1955-56. To this is added investment interest of £5,756, and after allowing £245,954 for taxation, the net profit is £205,105 (against £127,166). General reserve receives £130,000 and it is proposed to maintain the final dividend at 15 per cent, making 22½ per cent for the year (against 20 per cent). The balance carried forward is £102,069 (against £101,719 brought in).

George Kent, Ltd., has announced an interim dividend of 5 per cent (against 3 per cent). The increase is to lessen the disparity between the interim and final dividends and does not indicate a higher distribution for the year.

Johnson, Matthey & Co., Ltd., are paying an interim dividend of 3 per cent (unchanged).

Telephone Rentals, Ltd., has declared an interim dividend of 5 per cent (unchanged) on increased capital.

New Companies

Crompton Parkinson (Chelmsford), Ltd.—Registered 6th December. Capital £100. To acquire parts of the undertaking and of the assets and liabilities of Crompton Parkinson, Ltd. (incorporated in 1913) and to carry on the business of electrical engineers, workers in metals, contractors for the supply of electrical plant, etc. Directors: J. V. Daniel, M. H. L. Lewis, Michael Parkinson, R. R. Kenderdine, J. B. Scott and A. V. Sowman. Solicitors: Warren Murton & Co., 45, Bloomsbury Square, W.C.1.

Crompton Parkinson (Doncaster), Ltd.—Registered 6th December. Capital £100. To acquire parts of the undertaking and of the assets and liabilities of Crompton Parkinson, Ltd. (incorporated in 1913) and to carry on the business of electrical engineers, workers in metals, contractors for the supply of electrical plant, etc. Directors: G. R. Lewis, Michael Parkinson, J. V. Daniel, M. H. L. Lewis, R. R. Kenderdine and J. B. Scott. Solicitors: Warren Murton & Co., 45, Bloomsbury Square, W.C.1.

Crompton Parkinson (Stud Welding), Ltd.—Registered 6th December. Capital £100. To acquire parts of the undertaking and of the assets and liabilities of Crompton Parkinson, Ltd. (incorporated in 1913) and to carry on the business of electrical engineers, workers in metals, contractors for the supply of electrical plant, etc. Directors: F. Foster, R. R. Kenderdine, M. H. L. Lewis, J. V. Daniel, Michael Parkinson and J. B. Scott. Solicitors: Warren Murton & Co., 45, Bloomsbury Square, W.C.1.

E. K. Electronics (Industrial Amplifiers), Ltd.—Registered 28th November. Capital £6,000. Manufacturers of and dealers in amplifiers, television tube units, radio sets, television sets and apparatus, etc. Directors: H. W. Evans and E. K. Elphee. Regd. office: Brotherton Hall, Brotherton, Knottingley, Yorks.

Andrews Electrical Co., Ltd.—Registered 28th November. Capital £500. To acquire the business of electrical contractors carried on by B. E. Andrews, trading as Andrews Radio, Ltd., at 101, Pancras Road, N.W.1. Directors: B. E. Andrews and Mrs. Muriel E. Andrews. Regd. office: 101, Pancras Road, N.W.1.

Increases of Capital

Ericsson Telephones, Ltd.—Increased by £1,000,000, in 5s ordinary shares, beyond the registered capital of £1,300,000.

Bush Radio, Ltd.—Increased by £520,000, in 5s ordinary shares, beyond the registered capital of £80,000.

Aluminium Wire & Cable Co., Ltd.—Increased by £700,000, in £1 ordinary shares, beyond the registered capital of £500,000.

Gothic Electrical Supplies, Ltd.—Increased by £100,000, in £1 ordinary shares, beyond the registered capital of £50,000.

Liquidations

Contacts, Ltd., manufacturers of electrical contacts, 17, Bedford Row, London, W.C.1.— Winding up voluntarily. Liquidator, Mr. M. K. Forster, 3, Robert Street, Adelphi, London, W.C.2, appointed 29th November.

Battenberg & Co., Ltd., electric lamp fittings manufacturers, 6, Great Winchester Street, London, E.C.2.—Winding up voluntarily. Liquidator, Mr. K. R. Cork, 19, Eastcheap, London, E.C.3, appointed 26th November.

Bankruptcies

G. S. Whiston, 112, West Street, Crewe, electrical engineer.—Order made 8th November suspending discharge for one month, bankrupt to be discharged as from 8th December, 1957.

C. H. Marshall, 31, Lombard Street, Newark-on-Trent, electrical contractor, and **J. G. Hallam,** 7, Grassthorpe Road, Sutton-on-Trent, electrical contractor, and carrying on business at 13, High Street, and Farholme Lane, Sutton-on-Trent, and at 18, Eldon Street, Tuxford, formerly carrying on business in partnership under the style of Marshall & Hallam at the above places of business.— Trustee, Mr. N. W. Osborne, 1, John Street, London, W.C.1, appointed 3rd December.

W. E. Crees, carrying on business in partnership with another at 171, Lavender Hill, Battersea, London, electrical engineer.— Trustee, Mr. C. T. Newman, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 3rd December.

T. T. Forrest, formerly carrying on business at 4-6, New Shambles, Kendal, Westmorland, as an electrical engineer.—Public examination 23rd January at the County Court Offices, 12-14, Stricklandgate, Kendal.

Power Supplies in Latin America

FROM A CORRESPONDENT IN BRAZIL

THE Inter-American Economic Conference at Buenos Aires ended, as all such meetings have done since the Bogota Conference of 1948, in a simple declaration of principles, instead of a binding code governing economic relations between the member States. One of the main objects of the Latin American delegates was to obtain more liberal assistance from the United States Government to develop power, transport and communication systems, all notoriously deficient south of the Rio Grande. They also hoped to create an Inter-American Development Bank to finance such projects. The United States representatives made it clear from the outset that their Government was not prepared to undertake further commitments and that a separate credit organisation would be superfluous in view of the existence of the International Bank for Reconstruction and Development and the Export-Import Bank. Latin Americans, on the other hand, consider the Banks' lending policies too rigid, the conditions imposed too exacting and the loans authorised inadequate for their needs.

From January, 1948, to July, 1957, the International Bank granted 65 loans, totalling U.S. $700 million to 15 Latin American Republics. Of the total U.S.$323 million was destined to develop electric power supplies and increase installed capacities in Nicaragua by 165 per cent, Uruguay 102 per cent, Salvador 89 per cent, Mexico 82 per cent, Chile 58 per cent, Brazil 53 per cent, Ecuador 37 per cent and Colombia 33 per cent.

The Export-Import Bank granted 134 loans, totalling U.S.$396 million, to 17 Latin American countries during the year ended 30th June last. Most of this went to finance improvements to transport services and only U.S.$26·6 million to purchase electrical equipment.

Attracting Private Capital

In the course of the debates the United States delegates emphasised that the Southern Republics should so order their internal financial and economic affairs as to attract private capital to assist development. Private capital, they said, was always available if the right investment conditions existed in the borrowing country.

Therein lies the snag. Although the bulk of Latin America's public services were created by private capital in the past they no longer interest investors owing to the widely-accepted principle that tariffs must be kept low in the public interest, regardless of the effects of inflation. As a result 20 per cent of Latin America's installed capacity is now in the hands of State enterprises and the proportion tends to increase. Nationalist opposition to foreign capital also acts as a deterrent to investments in certain countries. In Argentina the extensions of the C.A.D.E. and Italo electricity concessions, authorised by the Buenos Aires municipality in 1936, have been annulled by Government decree under nationalist pressure. Private capital is no longer forthcoming for new electric power enterprises and only the old-established supply companies continue to maintain, and even to amplify, their installations, while agitating for more realistic rates.

The American & Foreign Power Company's subsidiaries operate in eleven Latin American Republics, namely Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Guatemala, Ecuador, Mexico, Panama and Venezuela. Their combined operating or gross revenues amounted to U.S.$220 million at 31st December, 1953. The five electricity and tramway companies forming the ANSEC group in Argentina have been working at a loss since 1953 and, in order to pay the increased salaries and staff benefits imposed by the Labour Ministry in 1956, have been obliged to apply for a loan of 61 million pesos. The ANSEC group comprises five subsidiaries: Compañias de Electricidad de los Andes, del Este, del Sud and del Norte Argentina and Central Argentina de Electricidad.

Despite its difficulties the holding company plans to invest U.S.$500 million within the next five years for plant extensions in Brazil, Cuba and Mexico. In addition, U.S.$18 million has been voted to install commercial atomic reactors in those countries. One of 10 MW has been ordered from International General Electric and another of similar capacity from the Atomics International Department of the North American Aviation Corporation.

Inadequate Plant Capacity

The Latin American Republics, almost without exception, have failed in the past to amplify power supplies in step with industrial expansion and rapidly growing populations. Inadequate installed capacity is now slowing down development and forcing governments to invest large sums in new and existing installations. Plans approved to date provide for raising installed capacity in Latin America by 16,759 MW to 28,589 MW by 1965, as shown in the accompanying table.

Country	Estimated expansion MW	Capacity in 1965 MW
Argentina	3,350	5,493
Brazil	6,300	9,765
Mexico	1,491	3,513
Chile	625	1,620
Colombia	1,900	2,470
Peru	608	1,059
Cuba	382	732
Venezuela	435	1,030
Uruguay	903	1,235
Others	765	1,672
TOTAL	16,759	28,589

The Economic Commission for Latin America (CEPAL) estimates total expenditure for developing power supplies (electric, oil and coal) in Latin America during 1955-65 at U.S.$9,595 million, including the equivalent of U.S.$5,393 million in foreign currencies. Of this sum 57 per cent, or U.S.$5,469 million corresponds to electric power. CEPAL divides the total expenditure on power developments among three groups of countries. Group I includes Argentina, Brazil, Colombia, Chile and Mexico; Group II, Cuba, Peru, Uruguay and Venezuela; Group III, Bolivia, Costa Rica, Ecuador, Salvador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay and the Dominican Republic. Group I will absorb U.S.$8,085 million of the total investment, including the equivalent of U.S.$4,424 million in foreign currencies; Group II, U.S.$1,218 million, including U.S.$788 million for imports; and Group III, U.S.$292 million and U.S.$180 million, respectively.

The Argentine Government's programme provides for building a State-owned plant of 600 MW in stages of

100-150 MW, the first to be ready within two to three years of signing the contract. The cost is estimated at 2,000 million pesos. The S. Nicolas power station will supply an additional 190-200 MW early in 1958. Other long-term projects are under study, including a proposal to build a dam at the Salto Grande Falls, in which Brazil and Uruguay would participate. Two independent stations are projected, one for Argentina, the other for Uruguay, each to house eventually ten 70 MW turbines. The project would regulate the flow of the river and render it navigable as far as Corrientes and Monte Caseros, thereby benefiting Brazil to some extent, as well as the Plate Republics.

The electric power shortage in Argentina this year is estimated at 760 MW, but consumer demands are doubling every ten years and experts predict that there will again be a shortage of 650 MW in 1965.

The Brazilian Government's plan aims at raising capacity to 5,000 MW by 1960 and 8,000 MW by 1965. The cost is estimated at 40,000 million cruzeiros in national and U.S.$400 million in foreign currencies. The State Governments and two principal foreign supply companies, Brazilian Traction Light & Power and the American & Foreign Power Co., are co-operating in the Government's programme. Between 1954-55 installed capacity rose by 9·3 per cent to 3,017 MW and production by 12·8 per cent to 13,180 million kWh.

Although Colombia's potential water power resources are estimated at 5,400,000 h.p., total installed capacity amounted to only 352 MW in 1956. Shortage of power is at present the main obstacle to further industrial progress. In 1956 consumption increased 9 per cent and a number of steam and diesel generators were installed as an emergency measure to cover the increased demand. The Government now announces an ambitious long-term programme which will carry electricity to all parts of the country. A 150 MW station is nearing completion at Rio Bogota Falls to supplement supplies to the capital, 20 miles distant. Transmission lines are being erected from Bogota to Melgar and Girardot, on Rio Madalena. A 24 MW thermal-electric station, fuelled by oilfield gases, will be built immediately at Tibu, near the Venezuelan frontier. The complete programme, drawn up and administered by the Corporation of Public Services, provides for a 200 MW hydro-electric station at the Rio Bata Falls, north-east of Bogota, and nine other smaller developments, with initial capacities ranging from about 8 MW to 80 MW. The work will be financed by the Government.

Large Undeveloped Resources

Chile's hydro-electric potential is estimated at 6,000 MW, but little more than 6 per cent is available at present. In 1952 production was in the order of 1,700 million kWh and 198 companies were distributing electricity to 238 cities. Empresa Nacional de Electricidad (Endesa) was formed in 1944 to plan electric power developments and provide funds when private capital is not forthcoming. Endesa is a joint stock company, almost entirely owned by Corporacion de Fomento de la Produccion (Fomento), a Government agency responsible for promoting economic development. Chile received a World Bank loan of U.S.$15 million in November, 1956, the second in recent years, to aid Endesa's programme. This will increase generating capacity by 400 MW between 1956-62. Private companies will add another 166 MW. The total cost is estimated at U.S.$54·5 million, including U.S.$17 million for imports. Consumption has increased steadily over the past decade and sales by public service companies have risen 150 per cent. Power has had to be rationed in the Santiago-Valparaiso region and demand in the Concepcion area now exceeds supply owing to the setting-up of steel, metallurgical and paper industries.

According to CEPAL's calculations Mexico will spend U.S.$1,563 million on power developments between 1955 and 1965, including U.S.$963 million in foreign currencies, 57 per cent being for electric power. Between 1946-55 economic activity increased by 6 per cent annually, installed electric capacity by 10·1 per cent and the population by 3 per cent. In 1953 938 companies operated 1,201 electric power plants and production reached 5,800 million kWh, of which 43 per cent was hydraulic. Four principal companies supply most of the power. A notable increase in consumption has been registered, inflation has been checked and progress has been made in all sectors of the economy.

Colour Television

IN the discussion on the paper describing a flying-spot film scanner for colour television, which was read at the Institution of Electrical Engineers on 11th December and summarised in our last issue, Mr. G. G. Gouriet said that the continuous-motion flying-spot method of film scanning was still one of the best methods and probably *the* best. In applying this principle to colour television, there were many difficulties to overcome, but some admirable solutions had been found by the authors. Referring to the signal/noise ratio, he said the authors had put the blame to some extent on instrumental features, but he himself thought it was fundamental and had nothing to do with the choice of axes.

Dr. A. R. A. Rendall said the authors seemed to have entered the arena of controversy, since their equipment was designed for 525-line working. They had described a complex mechanism but they had fully realised the problems and had dealt with them in great detail and with considerable finesse. The overall picture was of an exacting problem tackled with great skill and infinite attention to detail but one wondered whether this meticulous accuracy could be maintained in regular everyday service.

Dr. E. L. C. White said he was not convinced that Mr. Gouriet was justified in his remarks about the instrumentation. They were not concerned with signal/noise ratio inherent in the incoming light. The noise was generated in the instruments and there was some doubt as to whether his attempt to get down to fundamentals was justified.

Mr. G. G. Gouriet replied that while it was true that noise was dependent on light, he had a feeling that area came in. The light could be concentrated and so doubled. The noise would be the same as if the light had been spread over twice the area.

Mr. L. C. Jesty said he was interested in the transmission of luminance not only from the colorimetry point of view but from the point of view of getting a place for the N.T.S.C. system. They might one day want to use luminance and if thereby they prejudiced the propagation of the signal through some inherent difficulty associated with the way in which the information was noted, they would have to think seriously about adopting the system.

Mr. Winter raised the mechanical problem due to lack of standardisation within the film industry of perforations, particularly on 16 mm. film. It would be interesting to know how this problem could be overcome.

Mr. Jacobs said that gamma correction was a difficulty with flying-spot scanners. The pre-correction circuits had to be held to exceedingly close tolerances in order not to introduce unwanted colour errors in the reproduced pictures. Black level was also critical.

ADVANCED POWER REACTORS

POSSIBLE FUTURE DEVELOPMENTS OUTLINED

IN a lecture delivered on 5th December before the Institution of Electrical Engineers (in conjunction with the British Nuclear Energy Conference), Dr. J. V. Dunworth, Head of the Reactor Division, U.K. Atomic Energy Authority, Harwell, discussed possible advanced types of power reactors. The coolant, he said, could be either molten sodium, a gas, heavy water, ordinary water or some alternative liquid containing light hydrogen atoms. There were other possible liquids, but, for economic reasons, none seemed particularly attractive. A very severe restriction arose from the necessity for the liquid not to absorb neutrons strongly.

Four possible moderating atoms for a thermal reactor were those of light hydrogen, heavy hydrogen, carbon and beryllium. There were other possibilities, such as molten caustic soda, for specialised purposes, but no economically acceptable one had so far appeared for use in a large civil power reactor. Heavy hydrogen atoms could be used only in the form of heavy water. In any other compound containing heavy hydrogen, radiation broke up the material at a very rapid rate and the cost of recovering the valuable heavy hydrogen and re-forming the moderator material had so far appeared quite prohibitive. The most obvious way of using carbon as a moderator was in the form of graphite, and no satisfactory substitute had so far appeared. The beryllium atom could be used either in the form of metal or oxide, and since beryllia was much cheaper than beryllium metal it seemed likely that it would be used first in a large-scale civil reactor.

Fuel Elements

As uranium metal was readily attacked by pressurised water and gaseous coolants, serious consideration had been given to some alternative form of uranium fuel element and, for the various reactors listed, research was being directed mainly to the use of uranium oxide, though some consideration had been given to the possible use of uranium carbide. If present promise was fulfilled, a gradual change from metal to oxide seemed likely. Normally, there should be no corrosion of the fuel by the coolant, and this implied a barrier material. In the case of Calder Hall piles, a magnesium alloy known as Magnox had been developed for canning the uranium metal bars, while in the United States a zirconium tin alloy, Zircalloy 2, had been developed that was extremely resistant to attack by pressurised water. It was important, however, that if the canning should fail, the nuclear fuel should be corroded only slowly so that there was ample warning before a faulty fuel element had to be removed.

Fast Reactors

The earliest stage 3 reactor considered in the United Kingdom was a fast one, and an experimental system was now nearing completion at Dounreay, in the North of Scotland. That system could produce as much plutonium as was consumed, and, if properly designed, a substantial surplus, making it possible to burn all the atoms in ordinary natural uranium. In this respect the fast reactor represented a great advance over the stage 1 and 2 thermal reactors. The Dounreay reactor system made use of a solid fuel element cooled by molten sodium.

A further major problem was to secure a reasonable burn-up of the fuel elements before they had to be reprocessed because of metallurgical damage. In a thermal reactor a high burn-up was obtainable by diluting the fuel, but that was not possible to anything like the same extent in the fast reactor.

Thermal Stage 3 Reactors

One general type of thermal stage 3 reactor made use of solutions or slurries of fuel, either in pressurised water, in liquid metals or in fused salts. One concept envisaged that fuel, plus its liquid carrier, should circulate through the reactor and through the heat exchanger. In an alternative concept, the fuel was virtually static and a separate liquid or gas was used for transporting heat from the reactor to the heat exchanger. Dr. Dunworth listed the good features of the non-active heterogeneous and the active homogeneous reactors as follows. The non-active heterogeneous reactor had a simpler external circuit; no problem of fuel control; simpler maintenance; longer life—as a result of fewer corrosion problems; no waste disposal on site and fewer skilled staff required. The good features of the active homogeneous reactor were: no fuel problems; easier nuclear control; simpler fuel processing; and semi-continuous fission product removal.

Dr. Dunworth also dealt with fast reactors, homogeneous reactors, liquid-metal-fuelled reactors, high-temperature gas reactors and fused-salt reactors. The homogeneous aqueous reactor looked deceptively simple at first sight, but presented many formidable design problems. The uranyl-sulphate solution used in the core of the reactor was highly corrosive and, for good nuclear performance, had to be kept separate by a very thin neutron transparent window from a surrounding blanket of a slurry of thoria in pressurised heavy water. Fresh uranium 233 was formed in the blanket. Very little was at present known of the mechanism of maintaining the slurry in a reasonably uniform state and in preventing deposition round the circuit. Formidable problems arose, too, from the intense radioactivity in solution in the water, and that would obviously call for a very high standard of leak tightness.

Much less was known about homogeneous types of reactor systems based on the use of liquid metals. One of the preferred systems used solutions and slurries of uranium 233 and thorium in molten bismuth. As there were about 700 tons of molten bismuth involved and as bismuth had a disinclination to "go round the bend," preferring to go straight ahead and burst through, the magnitude of this problem needed no emphasis. The system, however, avoided the high pressures of the homogeneous aqueous reactor and could give much higher-temperature heat, but maintenance and general serviceability were at least as great a problem with the liquid metal system as with the pressurised water homogeneous reactor system.

Very little had been done in the United Kingdom on homogeneous systems based on the use of fused salts, and it was much too early to judge the application of this type of technology to a large land-based power station.

Only two technologies had been developed in any detail—the gas-cooled, graphite-moderated technology of

Calder Hall, and the pressurised-water technology developed for submarine propulsion in the United States. Both had involved a large number of staff for many years and it would be wrong to assume that some of the more complicated systems could be developed as easily. It would also be wrong to think that a large number of different types of reactor systems would be fully developed in the next 20 years, and that, in itself, stressed the great importance of selecting a few of the more promising systems at an early date and then, as far as possible, concentrating the country's resources on them.

A feature of the meeting was the relaying of the proceedings to the Irish Branch of the Institution of Electrical Engineers in Dublin, and the relaying, in return, of a vote of thanks by Mr. L. Collins, the chairman of that Branch. Mr. Collins said that the description of probable developments in power reactors to an engineering institution indicated a restoration of freedom of discussion between the scientific and the engineering sides. The lecture was also of great significance to small, non-industrialised countries such as Ireland, with limited natural resources which hoped in due time to benefit from the new source of power. Dr. Dunworth had explained his subject in an easy way to engineers with too short an acquaintance with this new and rapidly expanding science, the possibilities of which should be made known to peoples and governments. The scientist, therefore, must speak to others than his own scientific colleagues in unscientific terms, and in this the lecturer had struck a very happy balance.

RELAY MANUFACTURE

IT is now twenty-one years since Londex, Ltd., began its activities in the field of electrical automatic control. In 1936 the present three directors formed the company as consultants, suppliers and manufacturers of electrical controls, relays and timers. Early in 1939 a small factory was taken at Anerley and production commenced of a limited range of relays and timing units. The bulk of the work during the war years represented Government contracts and over 100,000 relays of one type alone were supplied for use in certain aircraft. At the beginning of the war the staff totalled 10, to-day the company employs over 400 in three separate plants. A dispersal factory was opened during the war to be carried on despite the attention South East London received from the enemy.

At the end of the war the staff stood at 70 and with Government wartime contracts completed the existing range of products was soon adapted to peacetime requirements.

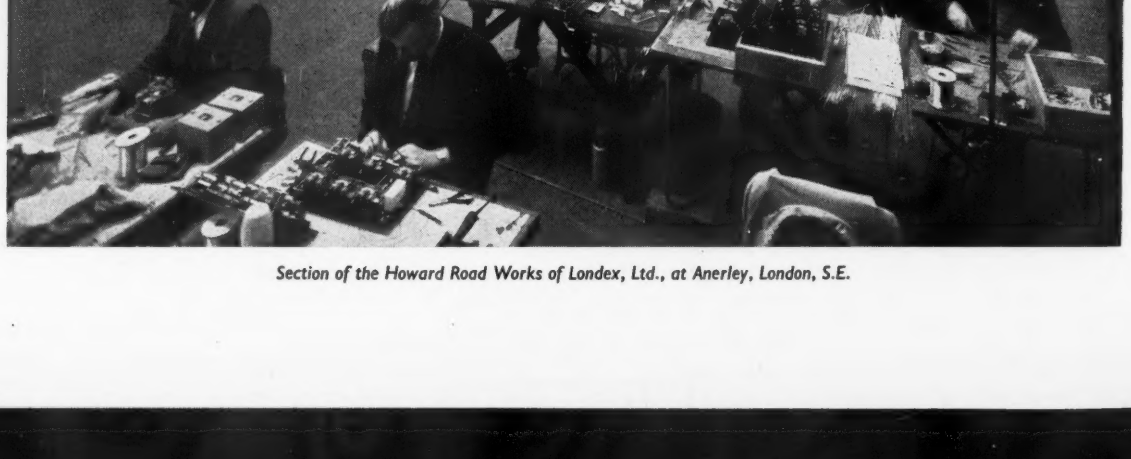
About this time research was taking place in conjunction with the Air Ministry to develop a remote control system for lighting marine buoys; this work was completed satisfactorily and Londex were then able to offer a new range of electrically operated marine beacons. Later a company was established to market this equipment; it was formed in conjunction with Chance Bros., Ltd., and titled Chance-Londex, Ltd.

In 1948 the existing premises of about 7,500 sq ft became inadequate and an additional works at Howard Road nearby was obtained which doubled the factory area. In a year or two this again was crowded and other premises in the district were added. Lastly, at the beginning of 1956, further premises were taken over at Howard Road, giving a total area of about six times that which existed in 1948.

To mark the occasion of its coming of age the company has published a well-produced 34-page data book entitled "Twenty-One Years of Progress." This not only outlines the history of the company but also gives comprehensive technical details of the range of equipment manufactured.

Nuclear Fuel Cycles Conference

The Institute of Physics has arranged a three-day Conference on Nuclear Fuel Cycles to be held at the Institution of Civil Engineers, London, on 15th, 16th and 17th January. Details may be obtained from the Institute.



Section of the Howard Road Works of Londex, Ltd., at Anerley, London, S.E.

Restrictive Trade Practices

HOW THE ACT IS BEING OPERATED

FOR a shilling a day one can have the run of all the files in the public Register of Restrictive Trading Agreements. This Register is maintained in accordance with the Restrictive Trade Practices Act, 1956, and, in London, it can be inspected in the search room on the seventh floor of the Registrar's offices in Chancery House, Chancery Lane.* At present the files contain over 1,400 such agreements, the contents of which were until recently probably as closely guarded by the parties concerned as those of the famous Silver Vaults in the building's basement. The second Order covering the remaining agreements, which are registrable under the Act, has now been approved by Parliament and these will be added to the Register next year.

Inspection Facilities

A helpful staff and two indexes, one alphabetical and the other grouping the commodities covered by agreements into broad classes according to industries, simplify the task of selecting the file containing the agreement one is looking for or at least narrowing down the choice to those files dealing with the same commodity. From personal experience it can be said, however, that where a number of related files are chosen, or even several selected at random, the byeways into which one's attention is subsequently diverted will probably be found to be not the least interesting or rewarding part of one's visit.

Adjacent to the indexes there is a large room, generously furnished with tables and chairs, where a lengthy investigation can be carried out in peace and quiet. While waiting for the chosen files to be brought by the attendant, it is worth admiring the splendid view over Lincoln's Inn Fields towards Westminster and also noting the efficiency of the electric floor warming installation that ensures warm feet and, most important, a clear head during one's labours.

Anyone who entertains visions of groups of recalcitrant manufacturers conspiring behind locked doors to exploit the public will find the contents of the files disappointing and rather dull. They contain, for instance, much more than details of specific restrictions, since the Act requires that a copy of the whole terms of the agreement must be disclosed and registered irrespective of whether they relate to the restrictions in question. There are, therefore, a great variety of papers ranging from formal legal documents to the constitutions of trade associations and other bodies, price schedules and technical specifications. All these provide a fascinating and illuminating insight into the workings of some of the less well-known commercial practices operated by British firms, many of whom will not until recently have considered that what they were doing involved any restriction at all.

General Disapproval

It should perhaps be pointed out that although by the title of the Act and by the requirement of registration Parliament has expressed a general disapproval of restrictive agreements it has only specifically banned those relating to the collective enforcement of re-sale prices. In providing that the agreements covered by Part I of the Act shall be impartially and judicially considered by a new branch of the High Court, effect has been given to the minority report of the Monopolies Commission on Collective Discrimination which stated: "We do not think that they [the industries] should be deprived of the benefits they derive from those practices without having an opportunity of having their cases examined individually." By adopting this judicial solution, which is the one that was favoured by industry, the last word will rest with the Courts, and not as might have been the case with an administrative tribunal, with a Minister and Parliament.

Nevertheless, it is clear from the number of agreements that date from the early part of this year that the Act has already caused industry to take a careful look at its practices in the light of the changed circumstances. In addition to the time and expense involved, a great deal of unwanted publicity must inevitably be incurred in defending an agreement before the Court. The circumstances in which the Court can allow an agreement to continue are narrowly defined in the Act, so that it appears that it may be very difficult to make out a convincing case in some instances. As a result it is probable that many agreements have already been abandoned and others will be abandoned before the formal proceedings are commenced. In any event it seems likely that the final number of agreements registered will be well below the various esimates, which have ranged from a semi-official 5,000 to an obviously wild guess of 40,000 in the Parliamentary debate.

Because of the heavy penalties that can be imposed for failing to register an agreement, or for providing false information, it is not expected that there will be many cases where agreements will be wilfully concealed. Anyone who suspects the presence of a restrictive agreement, such as a local council faced with common price tenders, can report the matter to the Registrar. If the agreement is not already registered, the Registrar will call on the parties concerned to state whether one exists and if he is not satisfied with their answers he can have them examined on oath.

Electrical Agreements Registered

So far as the Registrar and parties to an agreement are concerned, registration is only the first step in the lengthy legal process that will eventually lead to the agreement being allowed or disallowed by the Court. The Registrar is impartial and is obliged to bring all the registered agreements before the Court, although he may, as has already happened, be directed by the Board of Trade as to the order in which they should be presented. The two Orders so far made affect nearly 200 agreements covering 40 commodities. Those from the electrical industry, with the principal features of the agreements involved, are:—

Electric domestic cookers: fixing of discounts for certain classes of customers and prices for specified extras.

Electrical fractional horse power motors (not below $\frac{1}{20}$ h.p.): fixing of minimum prices, quantity discounts and discounts for different classes of customers.

Electrical subsidiary power instruments (these are ammeters and voltmeters of the dynamometer indicating

* The register can also be inspected at the Registrar's offices in Belfast and Edinburgh.

type, deflectional frequency indicators, power factor indicators, rotary synchroscopes and wattmeters): fixing of minimum prices and maximum discounts for different classes of customers.

Electric transformers: fixing of minimum prices and fixing of discounts for various types of transformers.

Electronic valves, including cathode-ray tubes: exclusive dealing arrangements between manufacturers, dealers and users; fixing maximum discounts; and restrictions on imports.

Electric resistance furnaces: fixing of certain price terms and conditions.

Water tube boilers intended to be installed on land: selection and adjustment of tenders prepared for home and some overseas contracts.

Preparing a Case for the Court

The rules for the new Restrictive Trade Practices Court have been laid down in cold legal language by the Lord Chancellor, and in general follow the familiar procedure of the High Court. It is at present expected that the first case will be heard in the middle of next year. This is not a long time when compared with an ordinary civil case, nor when account is taken of the complexities of the Act and the fact that everyone concerned is treading new ground. For not until the Court has sat and delivered its first judgments will there be any precedents or body of case law to act as a guide.

To find out something of what happens between registration and the final hearing, and also what is involved in the presentation of a case, we went to see Mr. B. M. Stephenson who is the senior Treasury solicitor attached to the Registrar's office. He and his colleagues will act for the Registrar and instruct counsel, in the same way as a private firm of solicitors will act for the parties to the agreement. As Mr. Stephenson emphasised, it must be clearly understood that the Registrar is not the prosecutor, but it is his duty to ensure that the complete case is brought before the Court and that all relevant information required by the members of the Court to enable them to reach a decision is available. The difficulty and work involved in this can be appreciated when it is realised that it may mean the minute examination of minutes of meetings going back over many years and the investigation of practices and other circumstances relating to the operation of the firms or industry concerned, which are usually thought of as questions for economists rather than lawyers.

The first action of the Treasury solicitors when they receive the papers relating to an agreement is to establish contact with the parties or trade association concerned, and where possible to arrange an informal and " off-the-record " meeting. This enables the common ground to be established at the outset and the general form of the proceedings to be planned. It will also often be necessary to decide who is to be the respondent. (This term is adopted since it is the agreement which is, so to speak, the defendant and the public the plaintiff.)

In theory, the respondent can be any of the parties to the agreement, but it is usual for the appropriate trade association to assume this role to avoid undue odium attaching to any one manufacturer. Normally the Court will require to be satisfied that each party to the agreement has knowledge of the proceedings and does not dissent from a representative respondent being appointed. Where, as in the case of the chemists, there are 9,000 parties this can be a lengthy operation. As in most instances an atmosphere of helpful co-operation is achieved at this meeting the subsequent tasks of investigation and establishment of facts on both sides are made much easier, and can often be started without waiting for the formal proceedings.

These commence with the issue of a Notice of Reference by the Court, which is equivalent to a writ in an ordinary civil case, and if a respondent wishes to be heard he must enter an appearance within 14 days of service of the Notice. His next task will be to deliver a statement of his case to the Registrar and to the Court, and to this the Registrar has to provide an answer. Great skill must be exercised in these pleadings, since neither party will normally be allowed to prove at the trial what is not in the statement of case or answer. In practice, every allegation of fact is deemed to have been admitted unless specifically denied or stated that it is not admitted by the opposite party. More detailed preparations for the final hearing will be necessary when application is made to the Court for directions.

As in normal High Court proceedings, the aim will be to save time and expense by narrowing the issue as far as possible before the case comes before the Court at the final hearing. This will involve the production and examination of documents by both parties and the answering of questionnaires by written and sworn affidavits. Where agreements on prices are involved the Court will probably also require a cost investigation. This complicated but necessary procedure is now being gone through for a considerable number of the agreements which the Board of Trade has directed the Registrar to bring before the Court.

Onus of Proof

Throughout these interlocutory proceedings, and more particularly at the final hearing, the onus of proving that the restrictions are not contrary to the public interest is put squarely on the shoulders of the parties to the agreement. Under the Act an agreement is presumed to be contrary to the public interest unless the parties concerned can satisfy the Court that this is not so or that there are special over-riding considerations that warrant its receiving exceptional treatment. (The agreement is therefore " guilty " until proved " innocent.")

In addition to evidence and argument, the respondent may call witnesses who may be affected by the agreement and cross-examine witnesses called by the Registrar. A fairer opportunity is therefore given to industry of proving its case than was possible before the Monopolies Commission. But since the Act, as has been already pointed out, narrowly defines the circumstances in which exceptions can be made, the Court's function will in the first instance be to decide whether or not the agreement passes one of the " gateways " set out in Section 21 of the Act. As industry is already discovering, although powerful arguments can be advanced in favour of an agreement, it may be no easy task to *prove* that it will pass a particular gateway. Even when the Court is satisfied on this point it will then further have to be convinced that the restriction is not unreasonable on balance between those circumstances and any detriment to the public. Only then will the agreement be allowed to continue and a note to that effect will be entered on the Register.

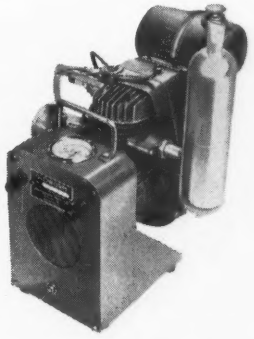
Where the Court is not satisfied with the case presented by the respondent the agreement will be disallowed and will then be void as regards the offending restrictions. The wider effects of such a negative decision on the industry concerned or on the structure of British industry in general are of course unknown. And not until several cases have been decided will any opinion be possible on the contribution that the Act is likely to make to economic efficiency and the well-being of industry and the country.

NEW ELECTRICAL EQUIPMENT

Battery Charging Plant

A compact and portable battery charging unit is offered by the WROXHAM ENGINEERING CO., Wroxham, Norfolk. Known as the "Gloworm Minor," it is claimed to be simple to maintain and operate and also inexpensive to run.

The power unit is a 34 c.c. two-stroke J.A.P. "petroil" engine coupled to a flywheel magneto supplying d.c. through a metal rectifier. A "no-load" switch is incorporated for easy starting and an ammeter is provided. The unit will charge at a rate of 12 A at 6 V or 9 A at 12 V.

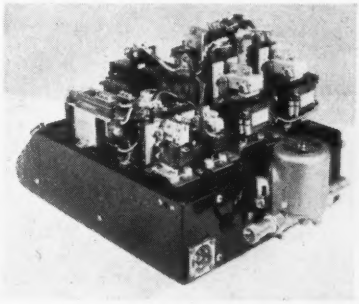


"Gloworm Minor" battery charger

Electronic Weld Timer

A new electronic timer has been introduced by BRITISH OXYGEN GASES, LTD., Spencer House, St. James's Place, London, S.W.1, for use with the "Argonarc" spot welding process. This process is applicable to the 18/8 group of stainless steels and to some of the new high-tensile stainless steels, including FV520 and FSM1.

Formerly, a condenser relay timer was used to time the duration of the weld, and an electro-mechanical process timer controlled the flow of argon which was used to cool the weld and prevent surface cratering and cracking of the fused zone. In the new equipment both timing cycles are accomplished by one electronic valve. The circuit can now be serviced with greater ease and the timer, which is mounted on the spot welding cabinet, is smaller and lighter than the unit which was originally used.



British Oxygen Gases weld timer

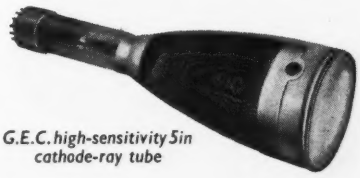
Flameproof Enclosures

There is a need in industry, especially in the electronics field, for a general purpose enclosure which would make various controls and instruments flameproof. Two such enclosures have now been produced by the SIMPLEX ELECTRIC CO., LTD., Oldbury. Both are Buxton certified for a variety of standard instrument chassis, meters, switches, push-buttons, indicator lights, transformers, etc., and an extended certificate may be obtained to cover special requirements.

These enclosures (one large, one small) may be variously joined to suit particular needs by means of a terminal box and an interleaving plate which has a maximum of twenty-six terminals. There are a variety of covers, according to need, for each enclosure. The units are made of grey iron and finished in hammered silver or blue.

High-Sensitivity C.R.T.

A new instrument cathode-ray tube, the 5 BHP, which combines a high-deflection sensitivity with low distortion and uses a new helical post-deflection accelerator system, has been developed by the Marconi-Osram Valve Co., Ltd., a subsidiary of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Intended primarily for use in wide-band measuring oscilloscopes, the 5in diameter flat-face tube has a Y plate deflection sensitivity of 1·5 mm/V under typical conditions. The high sensitivity is achieved with specially designed deflector plates, while the use of helical post-deflection acceleration and an aluminised screen enables a bright, fine trace to be obtained.



G.E.C. high-sensitivity 5in cathode-ray tube

Additional refinements of the tube are low inter-electrode capacitances obtained by making short side connections to the deflector plates, and provision for the adjustment of the potentials of auxiliary electrodes where extreme precision in deflection linearity and raster shape is required.

Heat-Light Fitting

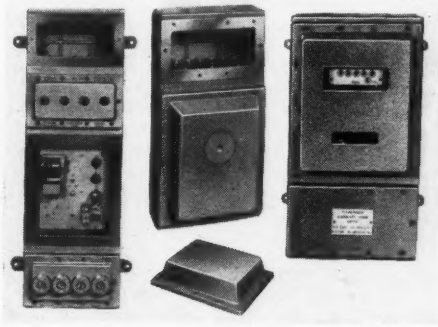
A new "Xcel" fitting designed to provide both radiant heat and light in the one unit is now being produced by the SELEX ELECTRIC CO. (KIRKBY), LTD., Yardley Road, Kirkby Industrial Estate, Liverpool.

It consists essentially of three parts. The first of these is a chromium plated brass reflector which is furnished with four tubular sheathed elements, wired in pairs and rated at 6 kW. Each pair of elements is separately switched. Secondly, there is an octagonal hammered glass bowl in a stove enamelled steel strip frame which houses a 300 W lamp. The third section is an octagonal open topped frame of amber coloured glass which houses four 60 W lamps. This is mainly for decorative purposes.

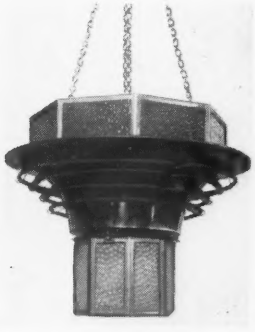
At a mounting height of 14ft the effective heating area claimed for the standard unit is in the region of 400 sq ft. The loading can be varied according to the users' requirements.

Infra-Red Heaters

An infra-red heater, the "Infrasil," of robust but light construction, has been announced by GRIMWOOD (CROYDON), LTD., 59-65, Cross Road, East



Simplex flameproof enclosures

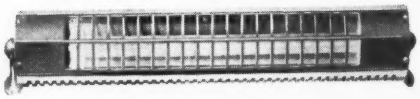


Selex "Xcel" heat-light fitting

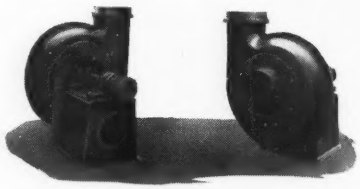
Croydon, Surrey. The element, available in 500, 750 and 1,000 W sizes, is protected by a silica tube and convection is provided by the design as well as radiant heat.

The heater is suitable for floor, wall or ceiling mounting and easily fitted diecast brackets allow for reflection at any angle. The body is stove enamelled in white, gold, blue, green or black which together with the anodised guards in silver, gold, red, green or black gives a wide choice of 2-tone colours. The price is £4 plus £1 16s purchase tax in the United Kingdom.

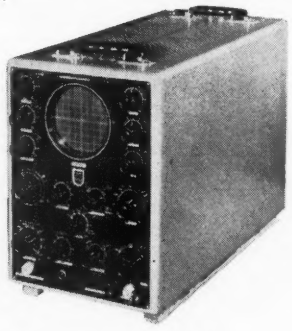
There is also an industrial model of the same design in one colour only, the price of which is £4. The company informs us that a larger industrial model will be available in the near future.



Grimwood "Infrasil" infra-red heater



Sturtevant-Acalor corrosion resistant fans



Philips wide-band oscilloscope

Corrosion Resistant Fans

It is announced that the STURTEVANT ENGINEERING CO., LTD., Southern House, Cannon Street, London, E.C.4, in conjunction with Acalor (1948), Ltd., have produced a range of moulded p.v.c. fans based on their original "Monogram" series. These fans, which are designed for exhausting corrosive fumes, have moulded casings and fully moulded p.v.c. impellers, thus permitting higher operating speeds and efficiencies than can be obtained with fabricated fans of this type.

At present two sizes are available with outputs ranging from 100 to 800 cu ft/min depending on the drive motor rating and speed. Larger models of these fans will be produced in due course.

Cathode-ray Oscilloscopes

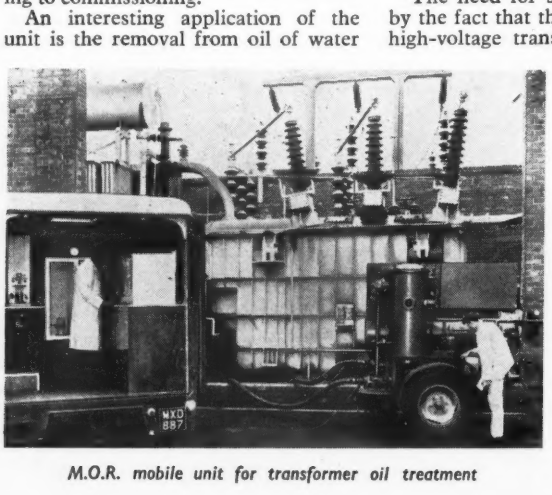
Two new oscilloscopes incorporating 10 cm cathode ray tubes with post-deflection acceleration, have been introduced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2. The first of these, the GM 5666, is a d.c. coupled oscilloscope which has been specifically designed for low frequency investigations in the mechanical, chemical, biological and medical fields. The other model, the GM 5662, incorporates a wide-band "Y" amplifier having a slow falling frequency characteristic and an extremely versatile time base. It is, therefore, particularly suitable for the observation of pulse-type phenomena.

Mobile Oil Conditioning Plant

A COMPLETE mobile unit for conditioning transformer oil has been put into service by Manchester Oil Refinery, Ltd. The unit comprises a test laboratory and transformer oil processing plant designed to carry out the degassing, dehydration and filtration of insulating oil at the site of erection of heavy electrical equipment. It is extremely flexible in operation and is capable of ensuring that the properties of transformer oil remain at the highest possible level from filling to commissioning.

An interesting application of the unit is the removal from oil of water which has accidentally entered the transformer. Such an operation is normally lengthy, tedious and costly, involving the use of electric power to heat the core, windings and oil, so that absorbed water and gas are eventually driven off. Treatment of this nature can normally take several weeks, but it is claimed that the M.O.R. unit will complete it in a matter of days and can raise the breakdown voltage of the oil well in excess of the requirements of B.S. 148/1951.

The need for such a unit is shown by the fact that the weights of modern high-voltage transformers—up to 160 tons—have made it necessary for manufacturers to reduce the transit weight by delivering them to site either gas-filled or under vacuum; they are then filled with insulating oil from bulk road tank vehicles, an operation which must be carried out with great care, especially in areas where there are contaminated atmospheres.



M.O.R. mobile unit for transformer oil treatment

The processing section of the unit comprises a coarse filter, oil heater, filter press and spraying tank, and pumps for circulation, vacuum drawing and delivery. Valves and interconnecting pipework enable different processing treatments to be quickly and easily selected. The maximum throughput rate is 1,100 gal/hr.

The plant utilises both static and dynamic vacuum dehydration concurrently, while a spraying technique further increases the rate of drying. By means of fine spraying into a region of low pressure the oil is given a large surface area facilitating dehydration which can then take place at relatively low temperatures.

To deal with the large amounts of water present in liquid form a heater bank is provided to raise the temperature of the oil to any desired level.

Filter units designed to operate over a wide temperature range ensure that all traces of impurities—fibre, paper and metal which may contain occluded moisture—are effectively removed. Further, the plant is so arranged that dried and degassed oil cannot be contaminated by moisture already eliminated.

The vehicle used for towing the processing plant is equipped as a mobile laboratory. It has facilities for executing most tests required by B.S. 148/1951, and water content, resistivity and dielectric strength tests up to 80 kV may also be made.

Electric Floor Warming

A New Activity for the Contractor

SINCE the established heating engineer was firmly wedded to water, air and steam as heat transmission agents, and looked on electricity as a most expensive luxury, electric floor warming was increasingly becoming the concern of the electrical installation engineer. After stating this in his paper on "Electric Floor Warming" to the Association of Supervising Electrical Engineers in London last night, Mr. W. F. Parker (technical director, Troughton & Young, Ltd.) said he was convinced that the future held considerable scope for electric space heating, which was of increasing importance to the supply industry, the national economy and the nation's health. Although hoping to stimulate much more practical interest in the subject by electrical engineers, he was not himself convinced that the floor was psychologically the best place to house the heating elements, but it had considerable advantages at present, and only time and experience would determine policy.

In the so-called "moderate" climate of this country an average indoor temperature of 65 deg F was considered comfortable for sedentary occupation, and the heating season lasted from the beginning of October to the end of April. However, the comfort conditions that a heating installation aimed to achieve and the period during which heat should be applied were both rather nebulous and the whole practice of heating was based on experience and accepted principles rather than scientifically proved data. There was a fundamental difference in the characteristics of heating by convection and by warmed floors, and it had been reported that a space heated by floor warming to an average air temperature of 61 deg F provided comfort equivalent to that of a similar space heated by a convection system to an average air temperature of 65 deg F. The use to which a building was put and its aspect would tend to affect running costs rather than the initial design and capacity of the heating system.

Electric floor warming compared in operation with the floor embedded hot water systems. Since both these systems operated at temperatures only 10 degrees higher than that of the room, they required a much greater heating surface area than radiators which operated with a 100 deg temperature difference. The hot water radiator was mainly a convection system with a considerable temperature gradient; the floor heating methods produced heat mainly by radiation with much less air movement and temperature gradient.

Method of Construction

To ensure that the storage capacity of the floor was fully utilised, the heating elements were cast into the structural slab. Where it was of solid concrete, or where hollow pots or pre-cast beams were used, they were laid on the constructional floor and covered by the floor screed. The insulated elements were therefore part of a homogeneous mass and whether they were laid direct or in a duct or tube, the small difference in heat dissipation could be ignored after the initial heating period when the floor heat losses had been absorbed. The type of floor finish or covering affected the emission of heat but not the total input of heat to the room. It was essential that the heating system should be designed in the early stages of the building planning if increased building costs were to be avoided. Architects and builders should also appreciate the importance of using modern materials and methods of construction that would reduce heat losses and effect economies in the capital and running costs of heating systems.

Electric floor warming must be designed for the particular building and it had been found in practice that very few buildings had sufficient thermal capacity to dispense with a mid-day boost at some period of the year. Since the installation costs were much less than those of comparative systems it was essential that the initial loadings should err on the high side as this would not materially affect running costs. All types of electric floor warming systems should aim at being either completely all-insulated or, if metal housing were introduced, having electrical and mechanical continuity, complete earthing facilities, ample wiring capacity and simple and effective means of connecting heating cables to fixed wiring. All components must also be able to withstand rough handling during installation. Since the heating load formed the major proportion of the maximum demand, the position of the distribution points was of considerable importance in effecting economy in sub-circuit wiring.

Choice of System

The various types of electric floor warming could be classified as (a) directly embedded and (b) rewirable systems. The directly embedded system using a galvanised wire heating element, fed from the extra low-voltage secondary of a double-wound transformer, was not only expensive for more than a very small installation, but it was difficult to calculate the loading accurately. Other resistance alloys had been employed to overcome temperature coefficient and corrosive effects of iron, and the use of low-voltage busbars in floor trunking reduced the number of transformers. The system using mineral insulated cable, with varying sized copper and Kumanal cores, could be most satisfactory if length of life was less important than cost. Heating cables having copper, Kumanal, nickel and Ferry conductors covered with extruded nylon and sheathed with p.v.c. or butyl or silicone rubber were also available for directly embedding, and the continuous development taking place was an indication of the future this cable was considered to have.

Similar heating cables were used for rewirable systems, and convenient housings could be obtained by the use of Ductube, which was inflated during floor construction and later deflated and withdrawn. Galvanised wire heating conductors in over-sized plastic tubes running between lengths of floor duct could form either a directly embedded or rewirable system. Aluminium and steel housings laid to form a grid and connected together by underfloor ducts were the most common. The heating cables were either connected to the "cold" sub-circuit by means of compound-filled junction boxes, or by means of specially designed glands. There did not seem to be any sound technical reason for the use of a wire mesh laid in contact with the metal housings to form a heat diffuser.

The ideal system was one in which a complete interconnecting housing was provided in the floor structure to cater not only for the heating cables but also to carry the wiring for other electrical and communication services.

Although a rewirable heating system was generally more costly than an equivalent directly embedded system, the considerable savings that could be effected in general wiring in the ideal arrangement made the costs of the two comparable when the additional facilities provided were also taken into account.

Room thermostats were the easiest, cheapest and most effective means of controlling both space and floor temperatures, but their type and position were of the utmost importance. The recently developed external controllers arranged to operate sections of an installation on both temperature and time basis were of considerable advantage when used to control heating installations on off-peak tariffs.

In conclusion Mr. Parker said that if a considerable off-peak heating load was to be developed greater inducement in the form of much more favourable tariffs must be provided. Since it was obviously uneconomic to install a system that would become obsolete in a fraction of the life of the building, electricity would inevitably replace other forms of fuel as a source of space heating.

Stage and Television Lighting Control

THE discussion on Mr. F. P. Bentham's paper on the electric control of stage and television lighting, which was read at the Institution of Electrical Engineers on 12th December and summarised by the author in our last issue, was opened by Mr. K. R. Ackerman (B.B.C.). He suggested that an attempt should be made to achieve some degree of standardisation of layout and operation. It was a real problem in the B.B.C. for there were about twenty lighting supervisors who might work in any one of the seven London studios. Thus it was difficult for them to achieve the high degree of familiarity with their control instruments upon which the best results depended. The design of the lighting desk had reached the stage where standardisation might be considered, but that was not true of patching systems.

Dr. H. H. Ballin (Atlas Lighting) referred to the thyratron control and said that the author tended to give the impression that that system was out of date. That was not the case. The two-valve system had been employed by his company on a large scale with recently developed biasing systems, and had been found to be vastly superior to the three-valve system. As the output was a.c. it was suitable for both tungsten and discharge lamp loads. Contrary to the statement made, no booster transformer was necessary, anode voltage drop being compensated for by using lamps rated at 10 V below line voltage. It could be used on single-phase supplies. The biasing circuit might be damped to give the equivalent of thermal inertia in incandescent lamps. That development had completely overcome early criticism of flicker and instability when controlling discharge lamp loads.

A further advantage of the two-valve system was that it did not require group load contactors for time delay purposes. With the biasing systems usually employed (valves normally non-conducting) delayed application of bias supply was adequate to prevent damage to valves. It might be effected by means of a small process timer or the like.

Mr. Stap (Philips, Netherlands) observed that the developments described in controlling television lighting were considerably in advance of anything at present available on the Continent and would be studied with great interest by lighting engineers in that field.

Mr. L. G. Applebee (Strand Electric & Engineering Co.) gave an interesting account of the development of stage lighting from before 1914 until the present day.

Mr. H. O. Sampson (B.B.C.) referred to the operation of the lighting console, and said that the purpose of installing that equipment in the B.B.C. was, first, to enable theatre-type lighting changes to be performed quickly and easily and, second, to enable lighting intensities to be balanced without the clumsy use of diffusers, thus improving the picture quality and simultaneously saving time.

To obtain optimum efficiency it was felt that the lighting supervisor was the most suitable person to operate the console, and not the studio electricians. The main reasons for the B.B.C.'s decision were (a) that the operator should have a thorough understanding of the television system to make the best use of the lighting console; (b) that because the lighting supervisor was responsible with the producer, scene designer and the technical operations manager for planning productions, he knew in advance what type of lighting effects were called for by the production and was thus the best person to achieve them; and (c) the operator of the console should be a person who possessed considerable artistic appreciation, and who was able to understand and interpret the lighting effects which the producer required.

Mr. A. W. Gostt (Philips Electrical, Ltd.) suggested that a more appropriate description of the lighting supervisor might be "lighting engineer artist" or something of that nature. He had to know not only the detailed operation of the panel, but quite a bit about what was going on on the stage or television studio floor, as well as about cameras and the techniques involved. It must take a long time to train a lighting supervisor to be an efficient operator.

Housing a Giant Synchrotron

THE reinforced concrete building now being constructed to house the giant proton synchrotron of the National Institute for Nuclear Sciences was among those referred to by Sir John Cockcroft in his paper "Building for Atomic Energy," which he presented to the Royal Institute of British Architects on Tuesday last. The proton synchrotron was, he explained, a magnetic race track for nuclear particles which was 150ft in dia. and consisted of 6,000 tons of magnetic blocks. The track had to sit on a surface which must depart from plane by less than 1 mm. A circular building 200ft in diameter had therefore been designed capable of taking this heavy load and of retaining great stability. When complete it would be covered with 10ft of earth to provide protection against the 7 billion volt particles that would be generated. A large amount of space had also to be provided for the experimenters, who would use powerful magnets to guide the particles to their experimental apparatus, and for the shielding blocks required to protect them.

Although stressing the importance of developing the use of electricity from nuclear power stations for space heating at off-peak periods, Sir John also referred to the fact that at Harwell waste heat from the BEPO reactor had been used for heating buildings for many years.

A heat exchanger placed in the outflow of the cooling air heated water to a temperature of 160 deg F, and this saved 350 tons of coal a year. A more ambitious experiment was being conducted in Sweden to supply water from a nuclear reactor at 120 deg C for district heating at Vasteras. The reactor would be moderated by heavy water, and would supply heat equivalent to 7,000 tons of coal a month. A second reactor was being built to supply a new Stockholm suburb at Fasta with heat, together with 15 MW of electricity.

INDUSTRIAL NEWS

Control of Outdoor Advertising

In representations made by the Advertising Association to the Minister of Housing and Local Government on his provisional draft of the alterations to the Control of Advertisements Regulations, it has emphasised the view that the new Regulations, as drafted, are far too complex to be understood. Even within the outdoor advertising industry itself there is no certainty as to the precise meaning of the schedules and so a shopkeeper or hotel proprietor could certainly not be expected to understand and act upon the new requirements.

The Association urges the retention of the present test for determining the boundaries of an "Area of Special Control," and it points out the difficulties confronting many people who display advertisements by "deemed consent" in conforming with the new conditions imposed by the Regulations.

Home Market and Export Trade

The need for freer trade in the home market was emphasised by Mr. Leslie Gamage, president of the Institute of Export, at the Institute's annual dinner held in London last week. In welcoming Sir David Eccles, President of the Board of Trade, he said that export trade, like charity, began at home. Free trade with Europe might be good but a free trade area in Britain was vital to successful export. He suggested that exporters should be given a roll of honour and that the favours of Government Departments should be confined to those on the roll.

Lewisham Railway Disaster

Last week Lieut.-Col. G. R. S. Wilson, chief inspecting officer of railways, Ministry of Transport, conducted an inquiry into the accident on the Southern Region of British Railways at Lewisham on 3rd December. After hearing a number of witnesses, particularly with regard to the signalling arrangements at the time of the accident (which occurred during a thick fog), Col. Wilson adjourned the inquiry until the driver and fireman of the steam train involved in the collision were well enough to give evidence.

Col. Wilson said that it was quite clear to him that the steam train passed a signal at danger which was protecting the electric train, but whether automatic train control would have prevented the accident might be decided when the driver and fireman of the steam train had given their evidence.

It was not certain whether automatic train control was suitable on a line so closely equipped with colour light signalling. Nevertheless the British Transport Commission had assured him and the Ministry of Transport that it would do all it could to accelerate the extension of automatic train control to all main lines in the country.

Import Duties Bill Amendments

The Government last week tabled amendments to the Import Duties Bill which showed that they have decided to abandon the proposal to establish an Import Duties Board to advise the Board of Trade on tariff rate changes.

Industrialists will continue to have direct access to the Board of Trade to ask for changes in duty, and these will be considered in the Department in the light of the criteria set out in the Bill.

Street Lighting Data

The Association of Public Lighting Engineers has resumed publication of the street lighting returns which it issued up to 1942 and replies to questionnaires sent to lighting authorities are collated in "Public Lighting Data (1955-56)," now available from the Association at 17, Victoria Street, Westminster, S.W.1, price 5s. A list of members of the Association is also included.

An introductory section gives explanatory notes and indicates the numbers of local authorities from which returns were received. This is followed by 82 pages of schedules, divided into two parts. Section 1 includes information on population, committee in control of public lighting, official in charge, mounting heights of lanterns, method of control and miles of trunk roads lighted. Section 2 analyses the type of lighting, roads lighted in accordance with Codes of Practice, other roads, total number of lanterns, period of lighting, local lighting rate per £ and product of 1d rate, energy charges (gas and electricity), maintenance costs, expenditure on new schemes and improvements, loan charges and capital expenditure.

The Association states that it is hoped to publish revisions every other year or every third year.

Electric Lighting Accessories and Fittings Industry

The Report on the Census of Production for 1954—Electric Lighting Accessories and Fittings (Volume 4) has recently been published (H.M. Stationery Office, 1s 9d). This analyses the returns made by 144 of the larger establishments in the United Kingdom (employing on average from 11 to over 500). Of the total 36 firms employed 100 or more. The gross output was £20·4 million, the net output £10·8 million and the number of employees (operatives and others) 15,259, with a total wages and salaries bill of £6 million. Capital expenditure totalled £678,000, and the net output per person employed (excluding outworkers and including working proprietors) was £708. The report includes tables showing the sales of the principal products of the industry, sales of other than principal products, and the purchases of material and fuel.

Devon Catering Exhibition

Nearly 1,000 hoteliers from various parts of Devon visited an electrical catering equipment exhibition recently held at the Victoria Hotel, Torquay, and inquiries valued at £14,000 were recorded. The three-day exhibition, which was the second such venture to be held, was organised by the Devon Sub-Area of the South Western Electricity Board with the co-operation of leading equipment manufacturers. A wide range of equipment was on display, selected chiefly for its

The display at the electrical catering exhibition held recently at Torquay

suitability for the medium-sized hotel to the small establishments. More than 4,000 personal invitations were sent out and support was given by local hoteliers' associations. The Mayor and Mayoress of Torquay (Councillor and Mrs. A. L. Goodrich) and the Deputy Mayor and Mayoress (Councillor and Mrs. E. G. Milford) paid a visit on the opening day of the exhibition at the invitation of Mr. G. T. Garwood, manager for Devon of the South Western Electricity Board.

British Columbia Trade Fair

The Government of British Columbia is sponsoring an International Trade Fair which will be held at Exhibition Park, Vancouver, from 1st to 10th May, 1958. Next year is British Columbia's Centennial Year and the Trade Fair is being advertised as one of the major attractions. Invitations to exhibit have been extended to all countries which trade with British Columbia; many have already accepted. The United Kingdom Government will participate with an official display of goods selected by the Council of Industrial Design from their Design Review. Exhibits will include electrical equipment, television and radio equipment, automotive, heavy industry, machinery, engineering equipment and plant transportation. Details can be obtained from the Agent General for British Columbia, Mr. W. C. McAdam, C.M.G., British Columbia House, 1, Regent Street, London, S.W.1.

Water Valves for Staythorpe Power Station

A contract for the supply of the main circulating and auxiliary water valves for the new Staythorpe "B" power station has been awarded by the Central Electricity Authority to Sir W. H. Bailey & Co., Ltd., Patricroft, Manchester. The value of the contract is £86,000 and it comprises a total of 97 valves, in diameters of up to 54in, twenty-eight of which will be electrically-operated, the remainder being motor-driven. The consultant engineers for the project are Balfour, Beatty & Co., Ltd.

Schoolboys Visit Henley's

Some 130 senior schoolboys, together with their masters, took part in an organised visit to the Birtley Works of W. T. Henley's Telegraph Works Co., Ltd., recently. They toured the works in parties showing great interest in the various manufacturing operations, and kept their guides very busy answering questions. The visit was organised with a view to interesting boys who were nearing school-leaving age in conditions and prospects in a modern cable factory. In welcoming the boys to the factory, the works manager, Mr. A. T. Winder, gave details of the company's education and training scheme. After the tour the boys were entertained to tea in the works canteen, where they also had an opportunity of examining a display of the company's products and an exhibition of Henley students' handicrafts. In the evening the works were again open to some 300 members of employees' families, and on the following day a further eighty similar visitors took the opportunity of visiting the works.

Welding Fire Hazards

The Fire Protection Association has issued a Bulletin on the fire hazards of cutting and welding. This describes the precautions that should be taken with both gas and electric equipment. It deals with safe methods of working and with the use and maintenance of equipment. It also includes a section summarising the precautions necessary with drums and tanks that have contained inflammable liquids. Copies of the Bulletin can be obtained free of charge on application to the Association at 15, Queen Street, London, E.C.4.

Lebanese Electrical Imports

The unsettled political situation in the neighbouring Arab countries, coupled with the general election, have had a disturbing effect on the Lebanese market. Imports of electrical goods from the United Kingdom, which increased by nearly 58 per cent to £651,450 last year, decreased to £209,120 for the first half of this year from £302,832 for the same period of 1956. The principal competition in this price conscious market was from the United States and Western Germany.

Long Life Contacts

What is believed to be a new long-life record for contacts has been set up by a contactor installed in the cold rolling reduction plant at Trostre of the Steel Company of Wales, Ltd. In three years the contactor, supplied by

Type DIL 5 contactor with long-life contacts

Klöckner Moeller England, Ltd., has needed no maintenance or repair, and the contact surfaces are still 1·3 mm and 1·1 mm thick, indicating a further six years of life, although the average life of similar contacts is only six months. Such endurance is illustrated by the company's guarantee that they will withstand 10 million operations without repair or maintenance.

The DIL 5 contactor consists of a hinged magnet system actuating the contacts by means of a toggle lever system. It has two normally open and two normally closed auxiliary contacts. The speed of operation, like that of the quenching of the arc, is dependent upon the speed at which the contacts break.

Radio-telephone Equipment for Canada

At a private electronics exhibition arranged in London last week by the Pye group of companies for members of the Canadian Trade Delegation, Mr. C. O. Stanley, chairman and managing director of the group, announced that Pye Telecommunications, Ltd., had received an order valued at over $100,000 for radio-telephone equipment for the Veterans' Taxi Cab Co., of Montreal. In making the announcement he put forward a suggestion for a transatlantic television cable, saying that a good television outlet from Britain to Canada might easily double the export of British consumer goods in a few years.

Whitaker's Almanack

The 1958 edition of Whitaker's Almanack once again contains information on almost every conceivable subject while the traditional and established features have been added to by new sections. The statistical tables have been increased by the inclusion of production figures of popular consumer goods, while the transport section gives details of the progress being made in the reorganisation of British Railways. The science notes contain preliminary information about the International Geophysical Year. The new Whitaker is, as usual, published in three editions: complete edition, cloth boards (18s 6d), shorter edition, paper bound (10s) and the library edition, bound in leather, with coloured maps (35s). It is published by J. Whitaker & Sons, Ltd., 13, Bedford Square, London, W.C.1.

South African Uranium Reserves

South Africa's indicated reserves of uranium oxide were the highest in the world, it was stated in a scientific paper before the Conference of the Atomic Industrial Forum in New York. The paper, prepared by Mr. R. B. Hagart and Mr. E. T. Pinkey, of the Anglo-American Corporation of South Africa, said that South Africa had about 370,000 tons of ore, and the actual reserves were almost certainly much higher. Generally there was no doubt that the South African industry would be capable of delivering a high tonnage of uranium oxide for many years after the completion of present contracts.

At present there were 17 uranium-extraction plants treating the residues from the gold-reduction plants of 27 mining companies.

Scottish Electrical Training Scheme

A conference of the Scottish Electrical Training Scheme, Ltd., was held on 9th December at which a report on the progress made during 1957 was submitted. The members are the Belmos Co., Ltd., the Harland Engineering Co., Ltd., the North of Scotland Hydro-Electric Board, Bruce Peebles & Co., Ltd., Honeywell-Brown, Ltd., Scottish Cables, Ltd., and the South of Scotland Electricity Board (founder members), and James Kilpatrick & Son, Ltd. (who join on 1st January next). The report records that there are seven graduates, fifty-three vacation trainees and fourteen pre-college trainees in training. A three-day course for schoolboys was held in July, and the first annual conference for all trainees was attended by most of the directors and members of the Executive Committee and by forty-three trainees. In anticipation of larger intake, the member organisations are arranging to increase the number of trainee vacancies available to the scheme. Two pamphlets are available, one setting out in full S.E.T.S. operations and methods of working, and a small three-fold leaflet summarising the scheme, for wider distribution. The address of S.E.T.S. is 127, St. Vincent Street, Glasgow, C.2, and the organising secretary is Mr. J. E. C. McCandlish.

U.H.F. Television Transmitter

The B.B.C. has recently installed at the Crystal Palace the first high-power u.h.f. television transmitter in Europe for the purpose of carrying out a series of tests in Band V (610-960 Mc/s) to obtain information on the possible use of this band for television broadcasting. The transmitter and aerial equipment is being hired from E.M.I. Electronics, Ltd., which designed and manufactured it at Hayes, Middx. It comprises a 10 kW vision transmitter and a 2½ kW sound transmitter. The vision frequency is 654·25 Mc/s, but the transmitter is available for operation anywhere within the frequency range 470-960 Mc/s (Bands IV and V).

B.B.C. Television Centre

The B.B.C. announces that it has placed orders for thirty television camera channels for the new Television Centre now being built at White City, London. Fifteen channels will be supplied by E.M.I. Electronics, Ltd., and fifteen by Marconi's Wireless Telegraph Co., Ltd. The cameras will use 4½in tubes of the "Image Orthicon" type. This type of camera tube has been decided upon after extended trials under the conditions of operation that will be encountered. It is hoped that three of the studios at the new Television Centre will be brought into operation during 1961, and a fourth early in 1962.

Of the thirty camera channels ordered, four working channels and one spare channel will be installed in each of the two larger studios, and three working channels and one spare channel in each of the other two studios. Others will be used as spares, and the remainder will be used for equipping additional studios as required.

Transformer Contract

Following the installation of two Brush 30,000 kVA transformers in Cape Town in 1956, the Brush Electrical Engineering Co., Ltd., has now received from the Cape Town Corporation an order for a further five large transformers. Three will be of 40,000 kVA and two of 30,000 kVA, and the latter will be fitted with the latest design of Brush tap-changing equipment. The order was obtained by Brush Group (South Africa), Ltd., an associated company of the Brush Group.

Porcelain Insulators for Toronto

The Canadian General Electric Co., of Toronto, recently took delivery of the first consignment of 180 kV porcelain bushing insulators supplied by Doulton Industrial Porcelains of Tamworth.

Calendars and Diaries

Reproductions from twelve original paintings in oils by Gilbert Wilkinson of British craftmanship surmount the monthly sheets of the calendar received from Chloride Batteries, Ltd.

Views from various parts of the world have been selected by Monsanto Chemicals, Ltd., for its calendar, which has large sheets each showing three months.

Scenes, in colour, from Denmark make attractive pictures for the calendar of the Danfoss Manufacturing Co., which shows two months on each sheet.

A hunting meet makes a colourful picture for the calendar of the Midland Electric Manufacturing Co., Ltd., the monthly slips of which also show the preceding and following months.

The British Vacuum Cleaner & Engineering Co., Ltd., has sent us a pocket diary in maroon leatherette which, in addition to the usual diary information and sectional maps of the British Isles, has a number of useful weights and measures tables.

The calendar of Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., has a charming picture of the early Georgian period, "The Portrait," showing a group examining a just-completed portrait of a lady.

A wild duck with her brood is the picture chosen by the Lindley Thompson Transformer & Service Co., Ltd., for its calendar, which has monthly slips showing the preceding and following months.

Once again C. A. Parsons & Co., Ltd., have chosen a set of scenic views for their calendar. Each monthly sheet bears an excellent reproduction in colour of a beauty spot in Britain.

Trade Announcements

To avoid any misunderstanding which may arise concerning the appointment of Lonor, Ltd., to handle the distribution of domestic electric appliances manufactured by Siemens-Schuckertwerke A.G., Germany, **Siemens-Schuckert (Great Britain), Ltd.**, Faraday Works, Great West Road, Brentford, Middx., a British-owned company, inform us that this arrangement was made by them in agreement with Siemens-Schuckertwerke A.G. and their associated concern, Siemens-Electrogerate A.G. Siemens-Schuckert (Great Britain) are the appointed agents in Great Britain and Northern Ireland for the range of electrical products, including marine electrical equipment, manufactured by the German combine, and all inquiries, except for domestic electric appliances, should be made direct through the British agents.

Thorn Electrical Industries, Ltd., has appointed Mr. G. Horlock as technical representative for the aircraft components division.

Wickham, Ltd., has recently installed a machine tool unit at its Coventry works for the purpose of cemented oxide tools research. The unit comprises three machines: a Max Muller Eltromatic lathe of special design, a Heller FH.160 milling machine, and a Carlstedt deep hole boring machine.

The new 8-storey building of the **Sun Electrical Co., Ltd.**, in Charing Cross Road, London, W.C.2, is nearing completion, in replacement of the building destroyed in 1940, and the company states that it has now reached the point where it is necessary for the contractors to integrate the new premises with the existing buildings. This will temporarily disorganise its showrooms, and to enable the work to be carried out these will be closed after business hours on 24th December and re-open not later than the end of March, when the new and larger showrooms will provide an improved service.

J. B. Hyde & Co., Ltd., have moved to Dale Street, Broadheath, Altrincham, Ches. (telephone: Altrincham 0842).

The **Midland Electrical Installation Co., Ltd.**, Upper Villiers Street, Wolverhampton, will be responsible for distribution and installation in certain parts of the Midlands of "Westair" air-conditioning equipment, and the **Shoolbred Electrical Co., Ltd.**, of Langley Street, Luton, will cover the area in and around Luton.

GENERATION and DEVELOPMENT

Distribution "Black" Areas

Addressing a meeting of the South Wales Electricity Consultative Council for the first time since his appointment as chairman of the Board, Mr. W. A. Gallon referred at Cardiff on Monday to the problems which the Board faced.

"We are very conscious," he said, "that many of our consumers are not getting the kind of supply we should like them to have. Voltages in some parts of South Wales leave much to be desired with the result that television, in particular, is affected. We shall deal with these black areas as quickly as we can."

Before the war South Wales was a distressed area and one consequence was that electricity consumption was low. Electricity consumption was still not as high as in most other areas but it had risen steadily from 982 kWh per domestic consumer in 1952 to 1,309 kWh per consumer last year, an increase of nearly 50 per cent. Increased consumption meant overloading of the old systems. To put matters right, the Board was incurring capital expenditure on improvement works of the order of £3 million a year. Relative to the size of the Area, South Wales faced perhaps the heaviest capital programme of any Board.

District Organisation in South Wales

Mr. Gallon also spoke of a proposed change in the Board's District organisation. He felt that efficiency must start at the local level where they were in closest contact with the public. Hitherto the Board had appointed an engineer and a commercial manager in each District but recently it had been decided to introduce at Port Talbot—where the district engineer, Mr. Garfield Richards, would be retiring during 1958—a district manager who would be responsible for all the Board's activities in the locality. By devolving responsibility to local levels, the Board felt that greater efficiency could be obtained and if the experiment proved successful district managers would be introduced elsewhere.

Heated Carpet Underlays

Last week the electrically heated carpet underlay was introduced by the North Western Electricity Board to consumers in its Area, examples being on show in the Board's principal service centres. The underlays are available in sizes 3 yd by 2½ yd, 3 yd by 3 yd, 3 yd by 3½ yd, and 3 yd by 4 yd, and the approximate loading of each is 12 W per sq ft. If the floor area allows for it, two underlays can be used.

This heating system was presented for the first time as a commercial product at an exhibition organised by the Merseyside and North Wales Electricity Board in Liverpool (see *Electrical Review*, 27th September).

Cooker Gift to Fife Consumer

Recently the South of Scotland Electricity Board connected the 100,001th consumer in its Fife Area and to mark the occasion the English Electric Co., Ltd., presented the consumer, Mrs. Brownlee, with one of the company's latest cookers. The presentation was made at the Board's Dunfermline showroom.

Smoke Control Areas

Five orders for the creation of smoke control areas under the Clean Air Act, 1956, have been confirmed by Mr. Henry Brooke, Minister of Housing and Local Government. They are orders made by Bolton, Denton (Lancs.), Hayes and Harlington (Middlesex), Ossett (Yorks.) and West Bromwich. They cover a total area of 380 acres and include 920 buildings.

Central Stores Depot for Plymouth

The South Western Electricity Board is building a central stores and repairs depot at Plymouth to replace three widely dispersed small depots which are now inadequate. Modern electric floor-warming will be employed throughout the building, which will be used for further research into this type of heating. Thermocouples and heat-flow meters are to be installed at a large number of points in the floor and experiments will be undertaken with different methods of electric underfloor warming and the application of thermal insulation to buildings. The new depot is expected to be completed by next July.

East Cornwall Improvements

Work is to begin soon on a project costing £135,000 to meet the increasing demands for more electricity in East Cornwall. This was announced at Liskeard last week when Mr. A. N. Irens, chairman of the South Western Electricity Board, visited the district. The new scheme will improve power supplies in the Liskeard, Callington, Saltash and Torpoint areas, and can also provide an alternative source of supply for Plymouth. A bulk supply substation is to be built at St. Germans.

Cromer Change-Over Completed

A silver switch first used at the commencement of the electricity supply provided by Cromer Urban District Council over fifty years ago was employed again when Mr. Arnold Wilkin, son of a former chairman of the Council, switched off the last electric light in the town to be supplied by d.c. The ceremony marked the completion of the change-over begun in 1937 and makes Cromer one of the first towns in Norfolk to be wholly supplied by a.c. by the Eastern Electricity Board.

OVERSEAS

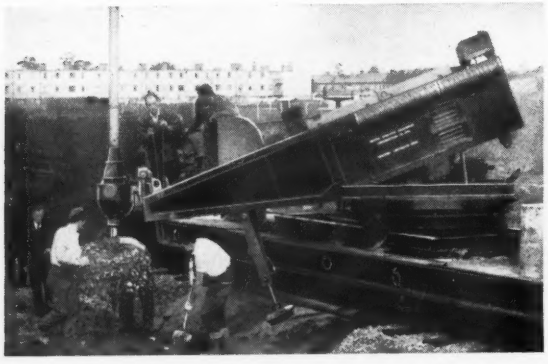
Rapid Expansion in Uganda

When the Uganda Electricity Board first started operating in 1948 about half a million kWh was generated monthly. Now the figure is over 14 million kWh a month, representing a 28-fold increase in ten years. All classes of consumers are demanding more electricity.

Danish Atomic Project Delayed

Reuter reports from Copenhagen that a Danish Atomic Energy Commission official said on 4th December that a serious defect had been found in an atomic energy reactor tank received from the United States which would cause a considerable delay in Denmark's atomic energy programme. The tank was to have been used in the largest of the American reactors at the Atomic Energy Centre on Risoe Island, west of Copenhagen.

When the tank had been given a water pressure test it appeared to leak in several places. The tank would normally contain sticks of enriched uranium and had these been put in in the tank's present condition there would have been an escape of radiation. If the tank can be repaired this will probably be done in Denmark.



Mechanical auger train at work on the Churchbury Loop between Forty Hill and Theobalds Grove stations digging holes for the foundations of overhead structures for the Liverpool Street, Enfield, Chingford, Hertford East and Bishop's Stortford electrification, which is scheduled for completion in 1960

PARLIAMENTARY REPORT

WHEN Welsh members called attention to the urgent need for more industrial development in North Wales because of the unemployment there, Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade, referred to the proposed nuclear power stations at Trawsfynydd and Edeyrn.

Of the first, he said that the Central Electricity Authority had applied to the Minister of Power for consent to build. Objections had been received, however, from the National Parks Commission and other bodies, so that there would have to be an inquiry.

"The nuclear power station at Edeyrn is most attractive from a technical point of view, being on a relatively rocky site and with an abundant supply of sea water for cooling purposes," said Mr. Erroll. "It is however too early yet to say when an application for consent to establish a station at this place will be made."

The Ffestiniog hydro-electric scheme was proving a small but useful source of employment. It was hoped that 700 people would be employed there by the end of next summer.

Mr. Goronwy Roberts, M.P. for Caernarvon, asked that the Government should indicate that public boards should have regard to local interests, especially when there was unemployment in the area of development. He referred particularly to the new showrooms, offices and stores which the Merseyside and North Wales Electricity Board proposed to build at Pwllheli. On this point, Mr. Erroll replied that it was a matter entirely for the Board. He understood that tenders for the construction of the new offices and buildings were invited in the normal way from several firms in the Board's North Wales area and the firm selected was in fact a Welshpool firm. There was nothing to prevent them from employing local people.

Scientific Research in Russia

Replying to a question by Mr. Thornton, Mr. Harmar Nicholls, Parliamentary Secretary to the Ministry of Works, said that measures were in hand to improve the availability of English language translations of Russian literature but the aim must be to encourage more scientists to learn to read Russian. The Government were considering appointing a scientific attaché to the Moscow Embassy.

Mr. George Thomas asked the Secretary of State for War whether the announcement by Lieutenant-General Sir E. Otway Herbert, General Officer Commanding-in-Chief, Western Command, made at a gathering of the Institution of Electrical Engineers at Chester on 11th November, to the effect that Russian scientific claims were not to be believed, was made with his authority.

Mr. Hare said that no authority was necessary. He understood that General Herbert's remark was that we should not believe *everything* the Russians told us.

Re-rating of Industry

During the debate on the second reading of the Local Government Bill, Opposition members renewed their demand for industry to be fully re-rated. Mr. J. R. Bevins, Parliamentary Secretary, Ministry of Housing and Local Government, said that the issue was not as simple as Labour members posed it. The effect of revaluation of industrial properties on the basis of current values would be to increase the proportion of rates paid by industry to about five times what it was before revaluation. There might be some firms which could take that added imposition in their stride, but there were others who might be forced to increase the prices that they charged to consumers both at home and abroad.

Restrictive Trading

In a brief debate on the Restrictive Trading Agreements Order, 1957, Lord Lucas of Chilworth supported the Chancellor of the Exchequer's recent plea to industry to abandon restrictive practices without waiting for the rulings of the Trade Practices Court, and to have more, not less competition. It now seemed clear, he said, that when the Opposition warned in 1955 that it would take years before the Restrictive Trade Practices Act made any impact on the lives and economy of the British people, they were right. During the last twelve months wholesale prices had dropped 6 per cent, yet retail prices had gone up 3 per cent.

Replying, Lord Mancroft, Minister Without Portfolio, said that no time had been lost in getting agreements registered and giving the first directions to the Registrar of Restrictive Practices. The task of the Registrar was a heavy one and it must be done properly. One could compare this type of case with the big commercial cases that came before the courts. The speed of progress was favourable when the comparison was made with them. The Registrar was trying to reduce the delay, but equally it would be undesirable that anything slapdash or casual should be done in anything as complicated and important as this.

Atomic Ships

Mr. Paul Williams asked the Parliamentary Secretary to the Admiralty whether he would make a statement on the research and development work which was proceeding on the possibility of building an atom-powered merchant ship.

Mr. Galbraith, Civil Lord, said research was going forward on the development of a system able to hold its own with conventionally-powered ships. There were a number of basically different reactors which might prove suitable. One of the most promising of these possibilities was an advanced form of the existing Calder Hall type of reactor. A considerable programme of work would be necessary before the stage was reached at which the building of a ship would be practicable.

Mr. Christopher Soames, Parliamentary Secretary to the Admiralty, informed Mr. Williams that the building of the nuclear submarine *Dreadnought* was proceeding as planned. It was too early yet to announce a launching date.

Cost of Nuclear Development

Mr. Hector Hughes asked the Paymaster General how much Britain had spent during the last five years in developing nuclear scientific processes.

Mr. Maudling said that for the five years up to 31st March, 1958, the gross expenditure on atomic energy authorised by Parliament amounted to about £340 million, exclusive of certain sums not disclosed for security reasons. This excluded expenditure on their own account by industry and the universities, for which no details were available, and expenditure on the civil nuclear power programme which, up to 31st March, 1958, was expected to be about £25 million.

Thermonuclear Research

The Prime Minister, Mr. Macmillan, replying to Mr. Roy Mason, said that the general state of progress of work on controlled thermonuclear reaction remained as explained to the House by the Paymaster General on 11th November. Promising results had been obtained in the apparatus "ZETA" but the interpretation of these would take time. There was full and mutually-beneficial collaboration between Great Britain and the United States on all research work in this field. One aspect of the collaboration was the adoption of common rules for the classification of information. The proposals of a joint United States-United Kingdom Committee for the declassification of certain categories of information were being considered.

Euston-Glasgow Electrification

Mr. G. R. H. Nugent, Parliamentary Secretary, Ministry of Transport, informed Mr. K. Robinson that the Euston-Glasgow electrification scheme was unlikely to be affected by the rephasing of capital investment and the estimate that the Euston-Rugby section would be completed in 1967 was unchanged.

DOMESTIC ELECTRICAL EQUIPMENT

Washing Machines

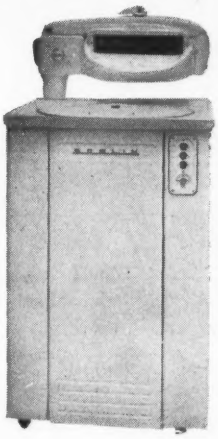
IN this and the following two surveys we shall be dealing with the home laundry, a branch of household activities that probably provides more opportunities for the use of electrical equipment than any other. There can be few homes in this country in which no laundry work is carried out and although all do not contain an electric washing machine the number of these machines in use has grown considerably in post-war years. The fitting of a heater is now generally accepted as being standard for most makes and only a few of the manufacturers listed do not include a heated model in their range.

There are three main types of washing machine—the smaller models that take up to about 4 to 6 lb dry weight of clothes and are usually provided with a hand type wringer; the more popular standard size with an average capacity of 9 lb dry weight of clothes and fitted with a powered wringer; and the fully automatic models. With the last-named types a complete cycle of operations enables the clothes to be washed, rinsed and dried nearly ready for ironing without the necessity of constant supervision.

The table-top lids of the cabinet washing machines provide useful additional working surfaces in the kitchen and it is probably for this reason that there are now fewer round types available. One of the latest cabinet models is the " Sunhouse " washing machine, a new product of H. Frost & Co., Ltd., while Hoover, Ltd., have introduced the " Hoovermatic," a combined washing machine and spin dryer.

Electric wash boilers (10th January) and spin and tumbler dryers (31st January) will be dealt with in our next two surveys.

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
ADA (HALIFAX), LTD., Westmount Works, Halifax, Yorks.	Mark I " De-Luxe "	Cabinet	36×22×22	8½ lb	2¾ kW	Rotary agitator	Power	Yes
	Mark VII " Coronation "	Cabinet	30×18×18	5 lb	2¾ kW	Rotary agitator	Power	Yes
BEATTY BROS. (TENBURY), LTD., Station Buildings, Stamford New Road, Altrincham, Cheshire.	" Beatty " 14.B	Round	48×24×29	9 lb	—	Agitator	Power	Yes
	" Beatty " 18.A Automatic	Cabinet	37×24×24	8 lb	—	Agitator	Patent " Flexatub " squeezes clothes	Yes
BENDIX HOME APPLIANCES, LTD., Albion Works, Kingsbury Road, Birmingham, 24.	" D "	Cabinet	36×26×22	9 lb	—	Tumble action	Spin dry	Yes
	" GH "	Cabinet	36×30×26	9 lb	2 kW	Tumble action	Spin dry	Yes
	" G "	Cabinet	36×30×26	9 lb	—	Tumble action	Spin dry	Yes
BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Goblin Works, Leatherhead, Surrey.	" Goblin " W.114	Cabinet	30½×18×18	4 lb	—	Oscillating agitator	Hand	No
	" Goblin " W.130	Cabinet	31⅜×18½×19	4/6 lb	2½ kW	Oscillating agitator	Hand	Yes
	" Goblin " W.140	Cabinet	34½×22⅜×22½	8/10 lb	2½ kW	Special rubber agitator	Power	Yes
BRUNLEC APPLIANCES, LTD., Junction Mills, Burnley.	" Vortex "	Cabinet	29¼×16×17⅜	4/5 lb	3 kW	Pulsator	Hand	Yes
BURCO, LTD., Rose Grove, Burnley, Lancs.	122	Cabinet	31½×19×21	5½ lb	—	Agitator	Hand	No
	122 H	Cabinet	31½×19×21	5½ lb	2½ kW	Agitator	Hand	No
	122 HP	Cabinet	31½×19×21	5½ lb	2½ kW	Agitator	Hand	Yes
	10 P	Cabinet	35¾×23×25	9 lb	—	Agitator	Power	Yes
	10 PH	Cabinet	35¾×23×25	9 lb	2 kW	Agitator	Power	Yes



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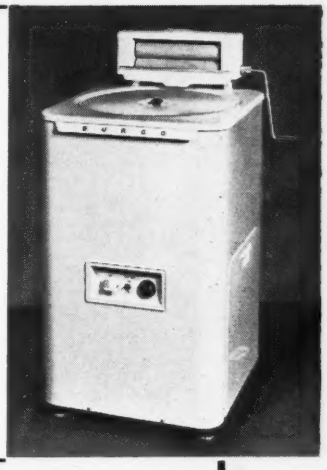

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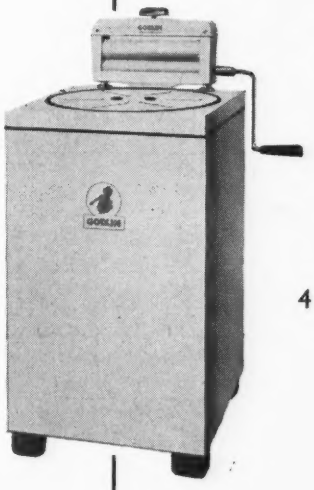
Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Cream or white enamel	Aluminium	£55 0 0 £49 0 0 (non-heated)	£24 15 0 £22 1 0 (non-heated)
Cream or white enamel	Aluminium	£49 4 10 £42 14 6 (non-heated)	£22 3 2 £19 4 6 (non-heated)
Vitreous enamel	Vitreous enamel	£49 4 0	£19 16 0
Vitreous enamel	Rubber	£116 12 6	£52 5 6
Vitreous porcelain enamel	Vitreous porcelain enamel	£75 0 0	£34 0 1
Vitreous porcelain enamel	Vitreous porcelain enamel	£101 2 10	£45 17 2
Vitreous porcelain enamel	Vitreous porcelain enamel	£98 19 6	£44 17 6
White enamel	Vitreous enamel	£33 12 0	£12 17 2
White enamel	Vitreous enamel	£47 15 6	£19 1 6
White enamel, vitreous top	Vitreous enamel	£65 12 6 £58 16 0 (non-heated)	£28 15 11 £25 16 0 (non-heated)
Cream or white vitreous enamel	Vitreous enamel	£35 0 0	£13 5 5
White with red accessories or cream with red or eau-de-nil acces.	Anodised aluminium	£38 0 0	£14 14 0
White with red accessories or cream with red or eau-de-nil acces.	Anodised aluminium	£42 0 0	£16 9 1
White with red accessories or cream with red or eau-de-nil acces.	Anodised aluminium	£45 0 0	£17 15 5
White or cream	Vitreous enamel	£58 10 0	£27 7 7
White or cream	Vitreous enamel	£63 0 0	£29 9 8



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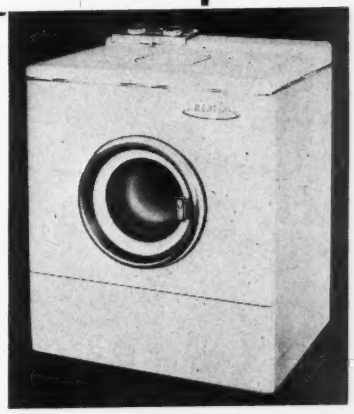
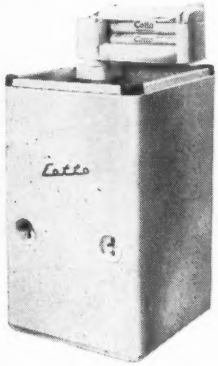


1. *B.V.C. "Goblin" W.140*
2. *Ada "Coronation" Mk. VII*
3. *Burco model 122 HP boiler/washer*
4. *B.V.C. "Goblin" W.114*
5. *Bendix model G "Gyramatic"*

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
CAREFREE DOMESTIC APPLIANCES, LTD., 69, Old Broad Street, London, E.C.2.	"Carefree"	Sink conversion unit	15×8 diameter	3 lb	No	Impeller	No	No
CLEGG & COUPE, LTD., Molesworth Street, Rochdale, Lancs.	"Prefect" Princess	Cabinet	41×19×19	5½ lb	1·9 kW	Four-bladed agitator	Power	Optional extra
	"Prefect" De-Luxe	Round	39×18 diameter	5½ lb	1·9 kW	Four-bladed agitator	Power	No
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley, Worcs.	"Dudley" 7501	Round	46×25×27	6 lb	—	Central reversing gyrator	Power	No
	"Dudley Invincible" 7700	Cabinet	36×21⅛×21⅛	6 lb	2 kW	Central reversing gyrator	Power	Yes
"COTTO" PRODUCTS, LTD., Enterprise Works, Scunthorpe, Lincs.	"Cotto" M.15/6	Cabinet	30×18×18	5/7 lb	—	Impeller	Power	No
EASICLENE PORCELAIN-ENAMEL (1938), LTD., Darlaston, South Staffs.	E.W.1	Cabinet	28×16×16	4½ lb	—	Agitator	Hand	Gravity drainage hose
	E.W.2	Cabinet	30×18⅜×18⅜	5 lb	—	Agitator	Power	Gravity drainage hose
	E.W.3	Cabinet	30×18⅜×18⅜	5 lb	2·7 kW	Agitator	Power	Gravity drainage hose
	E.W.4	Cabinet	28×16×16	4½ lb	2·7 kW	Agitator	Hand	Gravity drainage hose
EDY (GREAT BRITAIN), LTD., Farnley Low Mills, Whitehall Road, Leeds, 12.	"Edy Count"	Round	30½×17 diameter	5/6 lb	—	Pulsator, with time clock	Hand (extra)	Yes
	"Edy Final"	Cabinet	44×21×21	7/8 lb	—	Pulsator, with time clock	Spindryer incorporated	No
	"Edy Super-Twin"	Cabinet	32⅛×36×21	8/9 lb	—	Pulsator, with time clock	Spindryer incorporated	Yes
ENGLISH ELECTRIC CO., LTD., Domestic Appliance Division, East Lancashire Road, Liverpool, 10.	4004	Cabinet	48⅛×21¼×23 3/16	8/9 lb	—	3-fin central agitator	Power	Yes
	4005	Cabinet	48⅛×21¼×23 3/16	8/9 lb	2⅛/3 kW	3-fin central agitator	Power	Yes
ENTWISLE & KENYON, LTD., P.O. Box 39, Ewbank Works, Accrington.	"Ewbank" H.W.1	Cabinet	36×22×20	4½ lb	—	Plastic vaned agitator	Hand	No
	"Ewbank" H.W.2	Cabinet	36×22×20	4½ lb	—	Plastic vaned agitator	Hand	Yes



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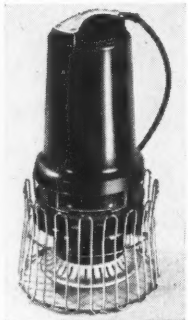

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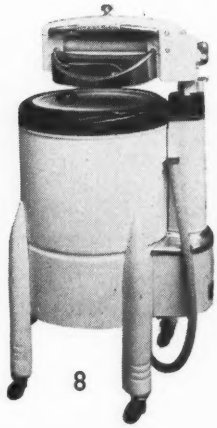

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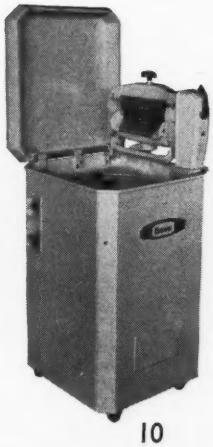
Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Maroon and black	—	£12 6 0	£5 8 0
Stoved enamel	Aluminium	£51 7 11 £44 17 10 (non-heated)	£22 11 1 £19 14 0 (non-heated)
Stoved enamel	Aluminium	£46 13 7 £38 10 7 (non-heated)	£20 9 8 £16 18 2 (non-heated)
Vitreous enamel	Vitreous enamel	£37 10 0 (a.c.) £45 18 9 (d.c.)	£18 0 0 (a.c.) £22 1 0 (d.c.)
Stoved enamel	Vitreous enamel	£55 3 0 £50 0 0 (non-heated)	£24 16 6 £22 10 0 (non-heated)
Cream or white stoved enamel	Aluminium	£41 14 0	£16 1 0
Stove enamelled	Porcelain enamel	£30 1 9	£11 5 4
Stove enamelled	Porcelain enamel	£48 18 1	£21 9 2
Stove enamelled	Porcelain enamel	£53 18 0	£23 12 11
Stove enamelled	Porcelain enamel	£35 6 0	£13 11 1
White vitreous enamel	White vitreous enamel	£30 0 0	£11 14 0
White vitreous enamel	White vitreous enamel	£69 0 0	£30 5 6
White vitreous enamel	White vitreous enamel	£92 0 0	£40 7 4
Cream or white stoved enamel	Alkali resisting vitreous enamel	£48 3 3	£21 2 9
Cream or white stoved enamel	Alkali resisting vitreous enamel	£55 9 3	£24 6 9
Ivory stoved paint	Porcelain enamel	£36 13 3	£13 15 9
Ivory stoved paint	Porcelain enamel	£38 3 3	£14 8 11



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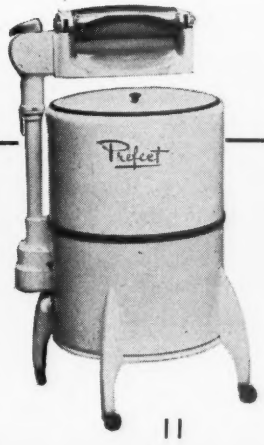

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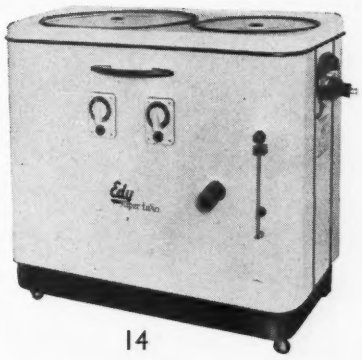

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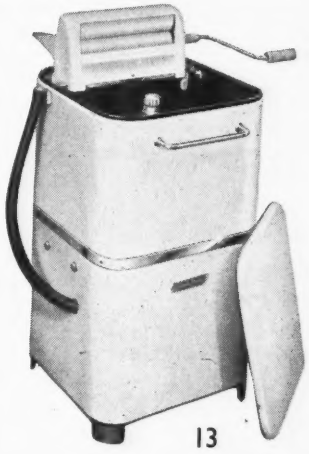

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6. *" Cotto " Products M.15/6*
7. *Carefree sink conversion unit*
8. *C.W.S. " Dudley " 7501*
9. *Clegg & Coupe " Prefect Princess "*
10. *Entwisle & Kenyon " Ewbank " PW.11*
11. *Clegg & Coupe " Prefect " round type washer*
12. *English Electric 4005*
13. *Easiclene model E.W.1*
14. *Edy " Super-Twin " model with spin dryer attached*

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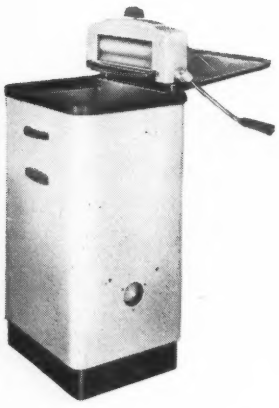

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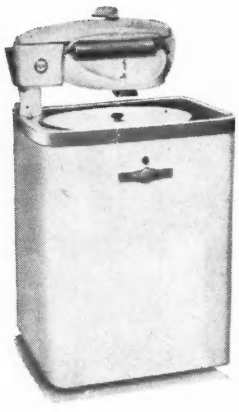

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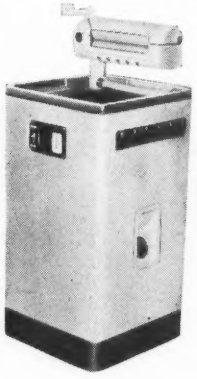

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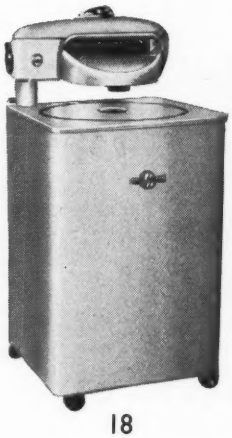

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Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
ENTWISLE & KENYON, LTD., P.O. Box 39, Ewbank Works, Accrington. *(continued)*	" Ewbank " H.W.3	Cabinet	36×22×20	4½ lb	3 kW	Plastic vaned agitator	Hand	No
	" Ewbank " H.W.4	Cabinet	36×22×20	4½ lb	3 kW	Plastic vaned agitator	Hand	Yes
	" Ewbank " P.W.10	Cabinet	36×20½×23	4½ lb	—	Plastic vaned agitator	Power	Yes
	" Ewbank " P.W.11	Cabinet	36×20½×23	4½ lb	3 kW	Plastic vaned agitator	Power	Yes
H. FROST & CO., LTD., Walsall.	" Sunhouse "	Cabinet	30½×14½×17¼	5 lb	—	Gyrator	Hand	Siphon system
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	DE.210	Cabinet	36×22½×22½	8 lb	—	Plastic agitator	Power	Yes
HOOVER, LTD., Perivale, Greenford, Middlesex.	Mark II	Cabinet	30½×17½×16½	6 lb	2 kW	Pulsator	Hand	Yes
	Mark III	Cabinet	30½×17½×16½	6 lb	2 kW	Pulsator	Power	Yes
	" Hoovermatic "	Cabinet	31½×29½×17	6 lb	3 kW	Pulsator	Spindryer 2,000 r.p.m.	Yes
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2.	" Empress "	Cabinet	36×23×22	9 lb	3 kW	Gyrator	Power	Yes
	" Princess "	Cabinet	29×17½×18	5 lb	—	Gyrator	Hand	Yes
	" Princess " (heated)	Cabinet	29×17½×18	5 lb	2 kW	Gyrator	Hand	Yes
			Table Top for " Empress," £2 7 3 plus 5s 3d purchase tax: Plastic Cover and Rinse Bowl					
KENWELL ELECTRIC, LTD., Meanwood Works, Spotland Bridge, Rochdale.	" Kenwell "	Cabinet	32¾×22×22	7 lb	—	Agitator	Power	Yes
LONGFORD ELECTRIC CO., LTD., 6, Grosvenor Street, Manchester, 1.	" Longford " H	Cabinet	31¾×22½×20½	7 lb	—	Reciprocating agitator	Hand	No
	" Longford " P	Cabin t	31¾×22½×20½	7 lb	—	Reciprocating agitator	Power	No

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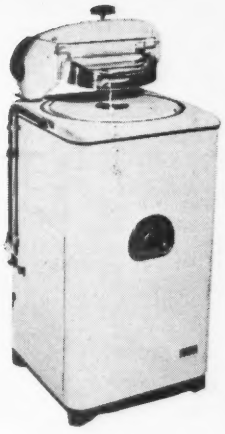
15. *H. Frost & Co.'s "Sunhouse"*
16. *Longford Electric Co.'s model P*
17. *Hoover Mk. III*
18. *Kenwell cabinet model*
19. *Hoover "Hoovermatic"*
20. *Parnall EW.50*
21. *G.E.C. model DE.210*
22. *Hotpoint "Princess"*
23. *Parnall "Thor" clothes washer with dish washing attachment*



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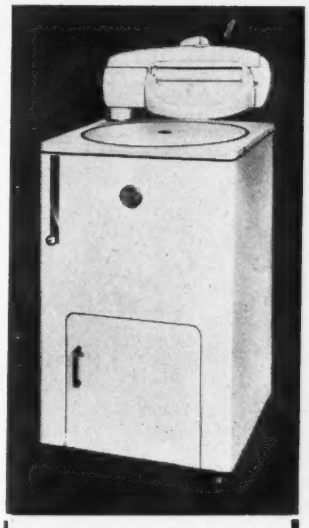

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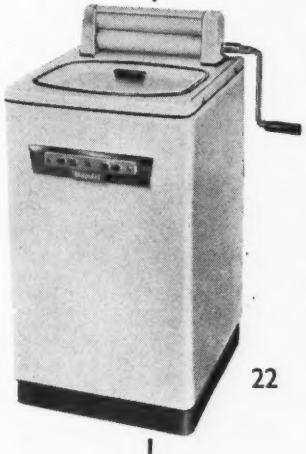

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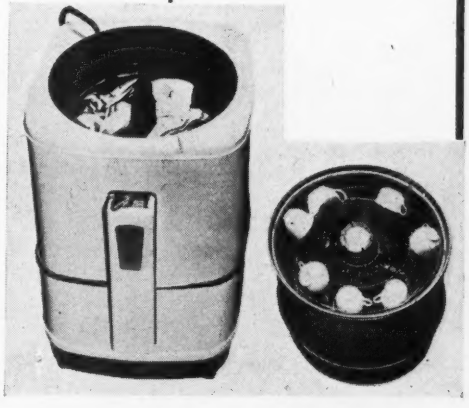

Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Ivory stoved paint	Porcelain enamel	£42 6 9	£16 5 6
Ivory stoved paint	Porcelain enamel	£43 16 9	£16 18 8
Ivory stoved paint	Porcelain enamel	£51 0 0	£22 7 7
Ivory stoved paint	Porcelain enamel	£55 6 8	£24 5 7
White stoved enamel	Anodised aluminium	£32 6 6	£12 13 6
White stoved enamel	Vitreous enamel	£57 13 1	£25 5 11
White enamel	Stainless steel	£44 10 0 £39 0 0 (non-heated)	£18 0 0 £15 10 6 (non-heated)
White enamel	Stainless steel	£54 4 6 £48 14 6 (non-heated)	£24 8 0 £21 18 6 (non-heated)
White stoved enamel, grey stoved enamel aluminium lid, blue base	Stainless steel washer tub, aluminium spindryer tub	£71 13 9	£32 5 3
Cream or white stoved enamel	Aluminium	£67 2 10 £57 13 1 (non-heated)	£29 9 2 £25 5 11 (non-heated)
Cream or white stoved enamel	Aluminium	£40 16 10	£14 16 2
Cream or white stoved enamel	Aluminium	£48 2 10	£18 0 2
for "Princess," £2 16 9 plus 6s 3d purchase tax			
Cream stoved enamel	Aluminium	£46 0 0	£20 14 0
White stoved enamel	Aluminium	£30 0 0	£12 10 10
White stoved enamel	Aluminium	£40 0 0	£18 9 8

Manufacturer	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
PARNALL (YATE), LTD., 255, North Circular Road, London, N.W.10.	E.W.50	Cabinet	36×20½×20½	5½ lb	—	Reciprocating Bakelite agitator	Power	Yes
	E.W.50H	Cabinet	36×20½×20½	5½ lb	3 kW	Reciprocating Bakelite agitator	Power	Yes
	"Thor" 244	Cabinet	36×25×25	8 lb	—	Reciprocating Bakelite agitator	Spin dry	Yes
JOHN SENIOR & CO. (1954), LTD., Holywell Green, Halifax.	"Joy" Standard Mk. I	Cabinet	32×22×22	8½ lb	—	Reciprocating agitator	Power	Yes
	"Joy" Standard Mk. II	Cabinet	36×22×22	8½ lb	—	Reciprocating agitator	Power	Yes
	"Joy" "Heat-o-matic" Mk. I	Cabinet	32×22×22	8½ lb	3 kW	Reciprocating agitator	Power	Yes
	"Joy" "Heat-o-matic" Mk. II	Cabinet	36×22×22	8½ lb	3 kW	Reciprocating agitator	Power	Yes
	"Joy" "Heat-o-matic" Junior	Cabinet	31×18×18	5½ lb	3 kW	Reciprocating agitator	Power	Yes
	"Joy" Standard Junior	Cabinet	31×18×18	5½ lb	—	Reciprocating agitator	Power	Yes
	"Joy" Junior (pumpless)	Cabinet	31×18×18	5½ lb	—	Reciprocating agitator	Power	No
W. & S. SUMMERSCALES, LTD., Keighley, Yorkshire.	"Fairy"	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator	Hand	Gravity drainage hose
	"Scales" S.1	Cabinet	30×17×17	8 lb	—	Rotary agitator	Hand	Yes
	"Scales" S.2	Cabinet	30×17×17	8 lb	—	Rotary agitator, automatic timing device	Hand	Yes
	"Scales" SH.3	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator	Hand	Yes
	"Scales" SH.4	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator, automatic timing device	Hand	Yes
UNIVERSAL BOILERS & ENGINEERING CO., LTD., Fulledge Works, Holmes Street, Burnley.	500	Cabinet	30×18×18	6 lb	—	Reciprocating agitator	Hand	No
	500H	Cabinet	30×18×18	6 lb	2 kW	Reciprocating agitator	Hand	No
	TS	Cabinet	33½×25×25	10 lb	—	Reciprocating agitator	Power	Yes
WILKINS & MITCHELL, LTD., The Green, Darlaston, South Staffs.	"Servis" De-Luxe	Cabinet	44×23×23	9 lb	—	Gyrator	Power	Yes
	"Servis" Superheat	Cabinet	44×23×23	9 lb	3 kW	Gyrator	Power	Yes
	"Servis" S	Cabinet	32×18×20	4½/6 lb	2·3 kW	Impeller	Hand	Yes
	"Servis Powerglide"	Cabinet	32½×19×20	4½/6 lb	2·3 kW	Impeller	Power	Yes

Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Vitreous enamel top, stoved enamel body	Vitreous enamel	£49 10 0	£22 5 6
Vitreous enamel top, stoved enamel body	Vitreous enamel	£54 19 8	£24 14 10
Vitreous enamel top, stoved enamel body	Vitreous enamel	£68 0 0 Dishwashing attachment:— £20 10 0	£30 12 0 Dishwashing attachment:— £2 6 1
Vitreous enamel top, stoved enamel body	Vitreous enamel	£49 0 0	£22 1 0
Vitreous enamel top, stoved enamel body	Vitreous enamel	£50 10 0	£22 14 0
Vitreous enamel top, stoved enamel body	Vitreous enamel	£54 0 0	£24 6 0
Vitreous enamel top, stoved enamel body	Vitreous enamel	£55 0 0	£24 15 0
Stove enamelled	Aluminium	£47 18 7	£21 11 4
Stove enamelled	Aluminium	£43 1 0	£19 7 6
Stove enamelled	Aluminium	£39 15 0	£17 17 9
White cellulose	Vitreous enamel	£36 14 0 £31 6 6 (non-heated)	£14 4 7 £11 17 9 (non-heated)
White cellulose	Vitreous enamel	£36 0 7	£13 18 1
White cellulose	Vitreous enamel	£38 14 11	£15 2 1
White cellulose	Vitreous enamel	£41 9 3	£16 6 2
White cellulose	Vitreous enamel	£43 12 3	£17 5 1
Stoved enamel	Hand tinned	£33 8 4	£13 16 10
Stoved enamel	Hand tinned	£36 9 8	£15 3 9
Stoved enamel	Vitreous enamel	£58 10 0	£27 7 7
White or cream or red, blue, green, yellow with white or cream	Vitreous enamel	£49 19 4	£22 9 8
White or cream or red, blue, green, yellow with white or cream	Vitreous enamel	£57 4 2	£25 14 10
White or cream or red, blue, green, yellow with white or cream	Aluminium	£42 0 0 £44 10 0 (with timer)	£16 19 4 £18 1 10 (with timer)
White or cream or red, blue, green, yellow with white or cream	Aluminium	£48 10 4 £44 3 5 (non-heated)	£21 16 8 £19 17 7 (non-heated)

24. *John Senior "Joy Heat-o-matic"*
25. *Universal Boilers model 500H*
26. *Wilkins & Mitchell "Servis Powerglide"*
27. *W. & S. Summerscales "Scales" S.H.4*
28. *Wilkins & Mitchell "Servis Superheat"*

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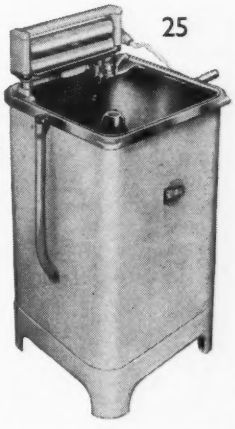

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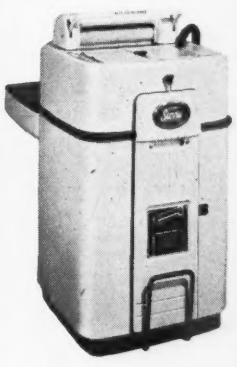

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 23rd December from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

11323. Londex, Ltd.—Earth leakage protection. 15th July, 1955. (788221.)

15589. Knobel, F.—Electromagnetic induction apparatus for fluorescent lamps. 26th May, 1954. (788222.)

15850. Philco Corporation.—Frequency sensitive electromechanical apparatus. 28th May, 1954. (788159.)

22029. Air Preheater Corporation.—Electrostatic precipitator supply control circuits. 28th July, 1954. (788058.)

23945. Associated Electrical Industries, Ltd.—Electron lenses. 11th August, 1955. (788162.)

35844. General Electric Co.—Luminescent display apparatus. 10th December, 1954. (788165.)

37516. Plessey Co., Ltd.—Contacts for electric switches. 31st January, 1956. (788169.)

1955

1824. Oldham & Son, Ltd., and Prout, L. R.—Portable electric battery lamps. 9th January, 1956. (788317.)

5592. Telephone Manufacturing Co., Ltd. —Alternating voltage stabilising arrangements. 24th February, 1955. (788110.)

7058. Soc le Carbone Lorraine, and Millet, J.—Electrical switch contacts. 10th March, 1955. (788177.)

8464/5. Arvin Electric, Ltd., and Cox, E. F.—Dry shavers. 14th June, 1956. (788304/5.)

8679. Dunlop Rubber Co., Ltd.—Thermo-electric pyrometer. 14th March, 1956. (788179.)

8804. General Electric Co., Ltd., and Drybrough, D. A. S.—Frequency changers. 26th March, 1956. (788231.)

9162. General Electric Co.—Frequency and phase control systems. 29th March, 1955. (788114.)

9591. British Thomson-Houston Co., Ltd. (General Electric Co.).—Microwave electron discharge apparatus. 1st April, 1955. (788323.)

11153. Philco Corporation.—Precision cathode-ray tube assembly. 18th April, 1955. (788073.)

12916. National Research Development Corporation.—A.c. motors. 4th May, 1956. (788234.)

13179. Licentia Patent-Verwaltungs Ges. —On-load transformer tap changing system. 6th May, 1955. (788117.)

13279. Metalastik, Ltd., and Watsham's, Ltd.—Cable spacers for multi-conductor electrical overhead transmission lines. 25th April, 1956. (788076.)

15130. General Electric Co.—Cathode-ray tubes. 25th May, 1955. (788189.)

17122. British Insulated Callender's Cables, Ltd.—Apparatus for winding electric cables, wires, ropes and the like. 13th June, 1956. (788326.)

18925. English Electric Valve Co., Ltd.—Grid controlled gas-filled discharge tubes. 4th May, 1956. (788328.)

22681. Syntron Co.—Electromagnetic vibratory conveyor motors. 5th August, 1955. (788246.)

23910. Automatic Telephone & Electric Co., Ltd.—Signalling devices. 14th August, 1956. (788124.)

33297. Air Preheater Corporation.—Electrostatic precipitator. 28th July, 1954. (Divided out of 788058.) (788059.)

33590. Emag Elektrizitäts-Ges.—Mechanical rectifier circuits. 23rd November, 1955. (788261.)

33762. Scintex.—Device for signalling the extinction of an electric lamp. 24th November, 1955. (788202.)

34063. Bendix Aviation Corporation.—Phantastron circuits. 28th November, 1955. (788084.)

34811. Kraft, J.—Spinners for providing electric conductors or other cores with insulation or other covering material. 5th December, 1955. (788204.)

36022. Robertshaw-Fulton Controls Co. —Thermostatic control devices. 15th December, 1955. (788265.)

36729. General Electric Co.—Television receivers. 22nd December, 1955. (788131.)

36887. Philips Electrical Industries, Ltd. —Methods of providing an electrically conductive network on a support of insulating material. 23rd December, 1955. (788342.)

37263. Canadian General Electric Co., Ltd.—Heating units for electric cookers. 29th December, 1955. (788267.)

1956

68. Philips Electrical Industries, Ltd.—Method of manufacturing a partly internally silvered tubular incandescent lamp. 2nd January, 1956. (788269.)

1277. Calor-Emag Elektrizitäts-Akt.-Ges. —Devices for interrupting electric currents by explosive means. 13th January, 1956. (788208.)

2425. Allmänna Svenska Elektriska Aktiebolaget.—Spark gap stack, preferably for valve type lightning arrestors. 25th January, 1956. (788271.)

2469. Western Electric Co., Inc.—Non-reciprocal circuit components. 25th January, 1956. (788345.)

3675. Zeiss Ikon Akt.-Ges.—Projection arc lamps and optical devices therefor. 6th February, 1956. (788272.)

5481. Standard Telephones & Cables, Ltd.—Circuit arrangement for the control of dictating machines connected with telephone systems, particularly PABX-systems. 22nd February, 1956. (788136.)

8651. Westinghouse Electric International Co.—Refrigeration apparatus. 20th March, 1956. (788213.)

9742. Sylvania Electric Products, Inc.—Electrical welding apparatus. 28th March, 1956. (788138.)

10341. Lambert, R. B.—Electric torches. 4th April, 1956. (788216.)

15568. Standard Telephones & Cables, Ltd.—Electrical supply apparatus. 18th May, 1956. (788279.)

18867. Soc. Française Radio Electrique.—Electric circuit-breaking devices. 18th June, 1956. (788283.)

19428. General Electric Co.—Electric bar lead seals. 22nd June, 1956. (788219.)

21932. Stichting Reactor Centrum Nederland.—Nuclear reactors. 16th July, 1956. (788284.)

26520. Standard Telephones & Cables, Ltd.—Electrical component strip assemblies. 30th August, 1956. (788287.)

29321. Sulzer Freres Soc. Anon.—Nuclear reactors. 25th September, 1956. (788288.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 27th December:—

BRADBREAKER. No. 769,696. Class 7. Machines for breaking coal, stone and foundry cores, and parts.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

PLESMET. No. 756,403. Class 9. Electric condensers.—Plessey Co., Ltd., 56, Vicarage Lane, Ilford, Essex.

ARMSTRONG. No. 757,284. Class 9. Radiogramophones, radio receivers and chassis therefor, television receivers and chassis, sound recording apparatus, sound amplifiers and parts.—Armstrong Wireless & Television Co., Ltd., 25-27, Oxford Street, London, W.1.

TELERAMA. No. 762,330. Class 9. Radio, television, sound recording and sound reproducing instruments and parts.—A. E. Johnson, School Green Farm, School Green Lane, North Weald, Essex.

SWARTWOUT - AUTRONIC. No. 765,484. Class 9. Electric and electronic apparatus and installations for use in the supervision, checking and control of industrial operations and in the indicating, recording, calculating and furnishing of data and statistical information. —Swartwout Co., Cleveland, Ohio, U.S.A. Address for service, c/o A. A. Thornton & Co., 24-27, High Holborn, London, W.C.1.

AUTAPLOT. No. 767,054. Class 9. Scientific, electrical and electronic apparatus; nautical, surveying, signalling and navigating apparatus; radar and radio instruments; and parts.—H. N. Electrical Supplies, Ltd., Rochelle House, Brixton Hill Place, London, S.W.2.

CREDA. No. 768,406. Class 9. Electric switches, thermostats, vacuum cleaners, domestic electric floor polishing machines, electric coffee percolators; and electric automatic regulating apparatus for controlling the supply of electric current. CREDA. No. 768,407. Class 11. Heat pumps, warming plates, water heaters, wash boilers, heated drying cabinets, heated drying cupboards; air conditioning apparatus, refrigerators; electrically heated apparatus for making coffee; rotating spits, being parts of cooking apparatus; and apparatus incorporating electrodes for use in boiling liquids.—Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.

THE BROONS (design). No. 768,872. Class 9. Cinematograph films; television and radio instruments and apparatus; sound reproducing and sound recording instruments and apparatus; optical projection instruments and apparatus; and parts.—D. C. Thomson & Co., Ltd., Courier Buildings, Albert Square, Dundee.

SIMTROL. No. 768,732. Class 11. Installations for lighting, heating, steam generating, cooking, refrigerating, drying and ventilating and parts.—"Diamond H" Switches, Ltd., Gunnersbury Avenue, London, W.4.

MERPLEX. No. 768,128. Class 17. Electrical insulators and insulating materials.—Mersey Cable Works, Ltd., Linacre Lane, Bootle, Liverpool, 20.

BOOKS RECOMMENDED BY

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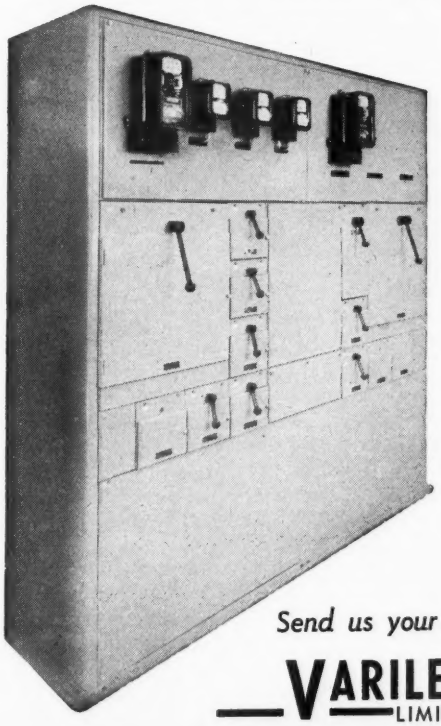

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Antrim.—Education Committee. Electrically operated passenger-goods lift in new technical school, Larne, Co. Antrim. The Education Committee, Antrim County Council, 475/477, Antrim Road, Belfast.

Armagh.—Education Committee. 13th January. Electrical installation in new technical school, Lurgan. A. W. G. Holt, consulting engineer, 74, South Parade, Belfast.

Australia.—P.M.G.'s Department, Melbourne. 6th February. Bells and buzzers. (E.S.B. 29619/57. Ten/29714.)*

State Electricity Commission of Victoria, Melbourne. 66 kV pin type insulators. (E.S.B. 29677/57. Ten/29752.)*

Southern Electricity Authority of Queensland, Brisbane. 7th February. 110 kV outdoor type switchgear unit. (E.S.B. 29507/57. Ten/29741.)*

Bethesda.—U.D.C. 31st December. Street lighting equipment. (See this issue.)

Canada.—Manitoba Hydro-Electric Board. 7th January. Three waterwheel-driven a.c. generators and associated equipment for Kelsey power station. (E.S.B. 29320/57. Ten/29761.)*

Edinburgh.—North of Scotland Hydro-Electric Board. Supply, delivery and erection of materials for 132 kV transmission line between Sloy and Killin. (See this issue.)

Formosa.—Central Trust of China, Taipei. 6th January. Telephone cable and switchboard equipment. 17th January. Three 60/60/20 MVA outdoor transformers and 18 sets of 69 kV circuit-breakers with current transformers, etc. (E.S.B. 29373/57.I.C.A. Ten/29670.)* 6th January. Materials and equipment for electrical installation at Wu-Sheh Dam. (E.S.B. 29379/57.I.C.A. Ten/29675.)*

Friern Barnet.—U.D.C. 3rd January. Renewal of electrical installations in approximately 100 Council houses. (See this issue.)

Greece.—Ministry of National Defence, Athens. 11th January. 500 dry cells for transmitter/receiver sets. (E.S.B. 29689/57. Ten/29790.)*

India.—Commission for the Port of Calcutta. 3rd January. Transformers, h.v. and l.v. switchgear, static condenser, l.v. distribution boards, cables, etc., for power supply at "B" and "C" berths, King George's dock. (E.S.B. 29876/57. Ten/29780.)*

Damodar Valley Corporation, Calcutta. 24th January. Plant, service and instrument air compressor with drive and accessories for Durgapur power station. (E.S.B. 29686/57. Ten/29757.)*

Iran.—Organisation du Plan. 28th December. Equipment for power station, including one 50 kW diesel alternator set, l.v. distribution network and power station building construction. (E.S.B. 29111/57. Ten/29691.)*

Customs Administration, Teheran. 4th January. Thirteen searchlights. (E.S.B. 29931/57. Ten/29810.)*

London.—India Store Department. 27th January. Unit rectifier No. 19. (See this issue.)

Londonderry.—Education Authority. Electrical installation in Belmont House Special School. A. T. Marshall, architect, Harbour Square, Londonderry.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

New Zealand. — Wellington Electricity Department. 11th February. Two 20,000 kVA transformers. (E.S.B. 29661/57. Ten/29754.)*

G.P.O., Wellington. 28th January. Transmitting aerial exchange and two galvanised steel towers. (E.S.B. 28891/57. Ten/29649.)*

Christchurch Electricity Department. 14th January. Weatherproof aerial cable. (E.S.B. 29821/57. Ten/29776.)*

Romford.—Corporation. 7th January. Electrical installation at Squirrels Heath School. (See this issue.)

Saddleworth.—U.D.C. 18th January. Street lighting equipment. (See this issue.)

South Africa.—Stores Department, South African Railways, Johannesburg. 8th January. Batteries and battery charger units. (E.S.B. 29895/57. Ten/29800.)* 22nd January. Flat and tubular copper busbars. (E.S.B. 29896/57. Ten/29801.)* 28th February. Lighthouse equipment. (E.S.B. 29897/57. Ten/29783.)*

Union Tender and Supplies Board, Pretoria. 16th January. Thirty rectifiers. (E.S.B. 29645/57. Ten/29768.)* Magneto bells, receivers, relays and transformers. (E.S.B. 29644/57. Ten/29753.)*

Cape Town Electricity Department. 13th February. 250 MVA switchgear for 11,660 V system and switchgear for 380/220 V system. (E.S.B. 29569/57. Ten/29763.)*

Thailand.—Royal Irrigation Department, Bangkok. 7th March. Construction of Yankee Dam, power plant and switchyard. (E.S.B. 16097/57. Ten/29717.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ayr.—Three-storey flats (36), as first instalment of the Belmont South scheme; burgh surveyor.

Barnard Castle.—Houses (16), Bridgegate, for the North Eastern Housing Association; P. L. Browne, Son & Harding, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.

Basildon.—Shops and assembly hall in Market Square; general manager to Development Corporation, Gifford House, London Road, Bowes Gifford, Essex.

Bexley.—Secondary school extensions; Buckle & Partners, electrical consultants, 2, Harrington Gardens, London, S.W.7.

Birtley (Co. Durham).—Factory and office accommodation, Vigo Lane, for Gorrills, Ltd., Tyre House, Corporation Street, Newcastle-on-Tyne.

Blackpool.—Church, Low Moor Road; Grenfell, Baines & Hargreaves, architects, 58, Topping Street.

Bournemouth.—Concert hall, café, bar, etc., in connection with the rebuilding of the Pier pavilion; borough architect, Town Hall.

Brackley.—Infants' school; J. Alan Turner, clerk to C.C., County Hall, Northampton.

Brighton.—Church at Braydon Avenue; Chichester Diocesan Fund and Board of Finance, Church House, 9, Brunswick Square, Hove, 2.

Cardiff.—New offices, Wood Street, for the Transport Department; E. C. Roberts, city engineer, City Hall, Cathays Park.

Chesterfield. — Offices, West Street; Kennings, Ltd., Clay Cross.

Coventry.—Second phase of Lyng Hall Comprehensive School, first phase of Binley Comprehensive School and second phase of Willenhall Wood Junior School; city architect, Bull Yard.

Croydon.—Factory and offices, Waddon Marsh Works; London Engineers Pattern Co., Ltd., Waddon Marsh Way, Croydon.

Cumberland.—School at Salterbeck; John Laing & Sons, contractors, Dalston Road, Carlisle.

Dagenham.—Office block for Stent Precast Concrete, Ltd., Chequers Lane; Tersons, Ltd., builders, 4, Dollis Park, London, N.3.

Edmonton.—Church hall and classrooms, Fore Street; Wm. G. Apps, architect, 4, Pollard Road, London, N.20.

Falkirk.—Health clinic and offices at Westbank (£48,047); burgh surveyor.

Gateshead.—Proposed Hill Head Secondary Modern School, and shopping centre at Beacon Lough; G. F. Winters, borough engineer.

Shops, Heaton Lough estate (£45,000); borough surveyor.

Ten-storey flats in Ann Street; G. F. Winters, borough engineer.

Gillingham (Kent).—Houses (76), Twydall/Beechings estate; F. Hill, town clerk, Municipal Buildings.

Goole.—Houses (163) and seven shops, Old Goole; borough engineer, Municipal Offices.

Grimsby.—Out-patients' department for Scartho Infirmary; C. Mackechnie Jarvis & Partners, consulting engineers, 34, Victoria Street, London, S.W.1.

Guildford.—Theatre, Old Foundry site; Guildford Theatre Co., North Street.

Houses (100), Park Barn estate; borough surveyor.

Extensions to County Technical College, Stoke Park, and to Burpham County Primary School, Burpham Lane; Surrey county architect, County Hall, Kingston-on-Thames.

Guisborough.—Hotel and cinema at West Road for A. Bailey, 143, Guisborough Road, Marton Moor, Nunthorpe.

Hanworth.—Methodist church, Churchfields Avenue; H. & H. M. Lidbetter, architects, 2, Verulam Buildings, Gray's Inn, London, W.C.1.

Hatfield.—New hospital at Hatfield Hyde (10-storey building) for North West Metropolitan Regional Hospital Board; regional architect, Sheffield Street, London, W.C.2.

Hebburn-on-Tyne. — Laboratories for A. Reyrolle & Co.; Cackett, Burns Dick & MacKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Hemel Hempstead.—Works extensions; Rotax, Ltd., Leverstock Green, Boxmoor.

Hetton.—Houses (30), High Street, U.D.C.; surveyor.

Ilkeston.—Houses (30), Kirk Hallam estate; E. & S. Halford, Ltd., builders, Park Road.

Kerrier.—Houses (64), St. Keverne; W. Thomas, clerk to R.D.C., The Willows, Helston, Cornwall.

King's Lynn.—Factory; Campbell's Soups, Ltd., 280, Euston Road, London, N.W.1.

Kingston-on-Thames.—Offices and flats, Vicarage Road; W. Chapman & Sons, Ltd., builders, 36, Black Lion Lane, W.6.

Lanarkshire.—Extensions to Hawksland Primary School, Chapelton Primary School and Sandford Primary School; I. V. Paterson, county clerk, Lanarkshire House, 191, Ingram Street, Glasgow, C.1.

London.—American Embassy building, Grosvenor Square, Mayfair; Pauling & Co., Ltd., builders, 112, Station Road, Sidcup.

Flats (20), Lawrie Park Gardens, Syden-

ham; A. Roberts & Co., Ltd., builders, 79, Eccleston Square, S.W.1.

Special school, Elmcourt Road, West Norwood; Oliver R. Croudace, Ltd., builders, 87, Godstone Road, Caterham.

Three-storey block of flats, Rosehill Road, Wandsworth, and 47 dwellings in two- and three-storey blocks, Saxby Street, Brixton Hill; R. H. Jerman, town clerk, Municipal Buildings, S.W.18.

Lutterworth.—Houses (38); Council's architect, Lutterworth, Leics.

Margate.—Special school at Millmead Road; Kent county architect, Maidstone.

Middlesbrough.—Secondary school at Prissick Farm and primary school at Easterside; K. J. Caton, education architect.

Newcastle-on-Tyne.—Twelve-storey blocks of flats (£500,000) and houses (152), Goathland Avenue, Longbenton; city architect, 18, Cloth Market, Newcastle-on-Tyne.

Peterborough.—Houses (42), Paston-Gunthorpe estate; S. B. Fairchild, 11, Welland Road.

Reading.—Science laboratories at Reading School, and branch library at Tilehurst; G. F. Darlow, town clerk, Town Hall.

Redcar.—Houses (137), Green Lane estate; Needham, Thorpe & White, architects, 5, High Petergate, York.

Salford.—Classrooms and physiotherapy block at Claremont Open-air School, Park Lane; city engineer, Town Hall, Salford, 3.

Sidcup.—Boys' home and hostel for working boys, Carlton Road; Kent county architect, Springfield, Maidstone.

South Shields.—Factory additions for Thermotank, Ltd.; Cackett, Burns Dick & MacKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Houses (100), Whiteleas; John Twiname, Ltd., builders, Cockermouth, Cumberland.

Proposed R.C. secondary school; Cairns & Byles, electrical consultants, 8, Osborne Road, Newcastle-on-Tyne.

Factory and offices, Jarrow Road, for Crushing, Screening and Engineering Co., Ltd., Bede trading estate, South Shields.

Walthamstow.—Flats (48), Knebworth Avenue; borough architect.

Pakistan's Electrical Imports

THE trade figures for Pakistan show that the United Kingdom is losing ground there. Whereas in 1954 Pakistan imported from the United Kingdom electrical goods valued at £4·8 million, the figures for the last two years have fallen to £3·8 million and £3·7 million, respectively. During 1956 the United States nearly trebled its exports to Pakistan, from £0·6 million to £1·8 million, and West Germany, by and large our major competitor, slightly lost ground from £2·9 million in 1955 to £2·5 million last year. The decline in the United Kingdom's position has been spread over a variety of products, but the main inroads have been made by German transformers and motors and American domestic appliances.

The sharp decline in Pakistan's earning power caused by the break in commodity prices after the Korean boom confronted her with balance of payments difficulties. To remedy these, and to enable the foreign exchange available to be devoted to development, she abolished open general licensing and introduced the severest restrictions on consumer goods imports. Her present policy is that existing essential industry shall have first claim on available resources, while such new industrial development as is possible with foreign aid and private investment shall be restricted to essential industry only.

Plans for increasing industrial development and food production are embodied in the draft *Pakistan Five Year Development Plan* published last May, which includes proposals regarding water and power, industry, transport and communication. The main projects, at present not yet under construction, are the Mangla multi-purpose scheme (a storage dam and a 300 MW hydro station), the Warsak grid system, the second unit and main scheme of the Ganges-Kobadak scheme, and several industrial units. While austerity continues and her policy is primarily directed towards stabilisation and expansion of her economy, Pakistan cannot be regarded as an easy market but, as the growing competition shows, she is certainly a worthwhile market.

IMPORTS IN 1956 (Private account) (Values in rupees. £1 = 12·4 rupees)

Product	Value
Turbo-generator sets	862,600
From United Kingdom	31,818
,, West Germany	117,391
,, Sweden	687,982
,, Denmark	25,409
Prime movers, n.e.s.	68,346
From United Kingdom	46,738
,, West Germany	20,952
Generators and dynamos	706,370
From United Kingdom	467,917
,, West Germany	117,879
,, United States	111,392
Motors	2,727,594
From United Kingdom	1,179,789
,, West Germany	1,017,767
,, Sweden	215,855
,, France	36,837
,, Italy	62,414
,, Denmark	61,300
,, Japan	69,539
Control gear	2,064,471
From United Kingdom	1,724,769
,, West Germany	333,548
Transformers	2,210,276
From United Kingdom	143,903
,, West Germany	1,683,030
,, Denmark	361,976
Refrigerators, domestic	1,569,739
From United Kingdom	399,970
,, Sweden	273,190
,, United States	874,985
Refrigerating equipment, n.e.s.	791,462
From United Kingdom	260,951
,, United States	502,278
Electrical machinery, n.e.s.	6,674,251
From United Kingdom	3,691,795
,, West Germany	2,037,671
,, Belgium	105,279
,, Italy	48,576
,, Switzerland	35,977
,, Japan	60,491
,, United States	618,475
Switchboards	218,138
From United Kingdom	105,203
,, West Germany	109,159
Porcelain ware	56,617
From United Kingdom	26,100
Fans	68,170
From United Kingdom	11,504
,, West Germany	37,999

Product	Value
Wire, rubber insulated	3,517,273
From United Kingdom	2,019,906
,, West Germany	1,374,220
,, Belgium	58,307
,, Japan	24,384
Telephone and telegraph wire	1,014,741
From United Kingdom	40,192
,, West Germany	922,090
,, Denmark	45,746
Copper wire	2,156,279
From United Kingdom	935,744
,, West Germany	501,885
,, Holland	622,107
Wire, n.e.s.	3,575,919
From United Kingdom	3,141,865
,, West Germany	206,595
,, Belgium	158,790
Telegraph and telephone apparatus	3,299,250
From United Kingdom	305,672
,, West Germany	2,908,802
,, United States	27,999
,, Sweden	24,182
Lamp bulbs, vacuum	53,582
From United Kingdom	33,633
,, Japan	14,910
Car bulbs	38,109
From United Kingdom	11,704
Torch bulbs	109,448
From United Kingdom	8,253
,, Holland	43,728
,, Hong Kong	40,933
Parts of electric lamps	94,967
From United Kingdom	18,946
,, Holland	31,199
,, Hong Kong	18,529
Fluorescent lamps	39,849
From United Kingdom	19,191
,, Holland	13,901
Lamps, n.e.s.	245,985
From United Kingdom	38,421
,, Holland	42,352
,, Hong Kong	135,317
Flash lamp batteries	1,008,173
From United Kingdom	26,498
,, France	120,327
,, Malaya	213,088
,, Hong Kong	487,179
Batteries, n.e.s.	1,038,341
From United Kingdom	393,130
,, France	255,742

Product	Value
From Hong Kong	140,272
,, United States	146,133
Carbons	255,357
From United Kingdom	191,350
,, United States	26,986
,, France	18,206
Accumulators	156,363
From United Kingdom	95,563
,, France	45,511
Condensers	120,685
From United Kingdom	116,641
Lighting accessories	955,219
From United Kingdom	268,367
,, West Germany	275,225
,, Hong Kong	138,144
,, Malaya	75,049
Meters	335,204
From United Kingdom	160,663
,, West Germany	84,864
,, Switzerland	25,114
,, United States	39,735
Instruments, n.e.s.	648,539
From United Kingdom	372,280
,, West Germany	210,404
,, Japan	22,603
,, United States	32,229
Electro-medical appliances	309,656
From United Kingdom	100,156
,, West Germany	115,751
Radio receivers	290,715
From United Kingdom	249,752
Receiver parts	1,936,716
From United Kingdom	1,204,832
,, West Germany	223,161
,, Holland	122,643
,, United States	326,453
Radio valves	20,772
From United Kingdom	13,014
Radio appliances, n.e.s.	377,141
From United Kingdom	161,923
,, Holland	200,807
Electrical apparatus, n.e.s.	3,705,871
From United Kingdom	2,244,426
,, West Germany	504,899
,, Belgium	84,990
,, France	103,946
,, Holland	176,945
,, Japan	103,057
,, United States	356,517
,, Australia	37,777

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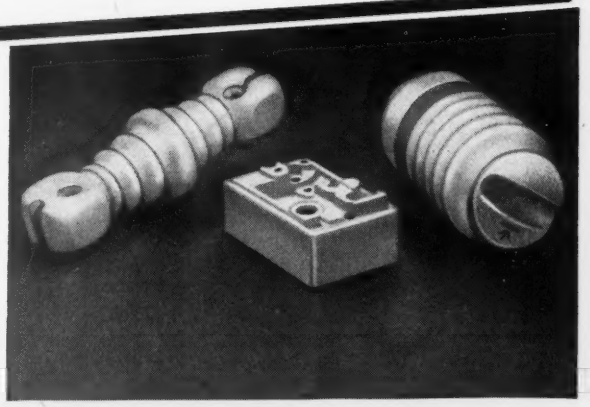

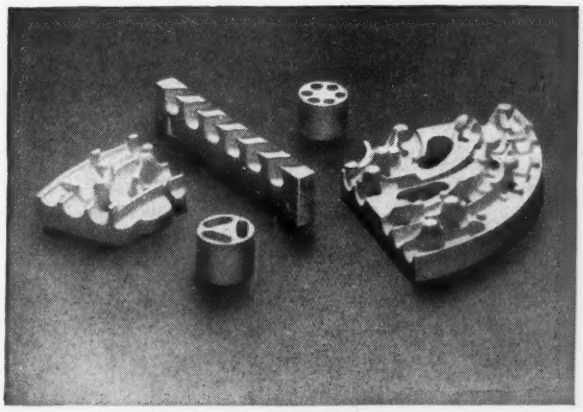

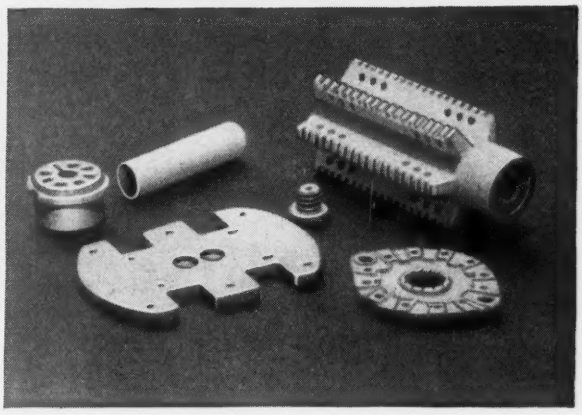

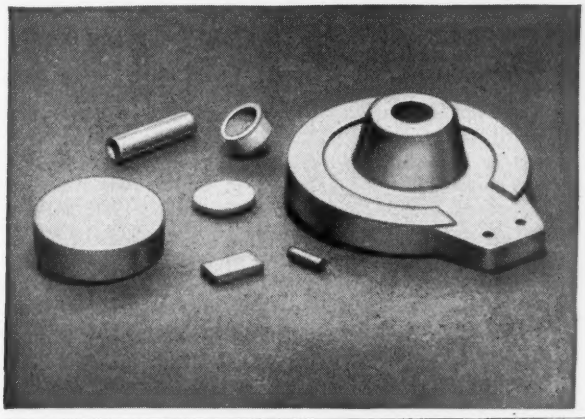

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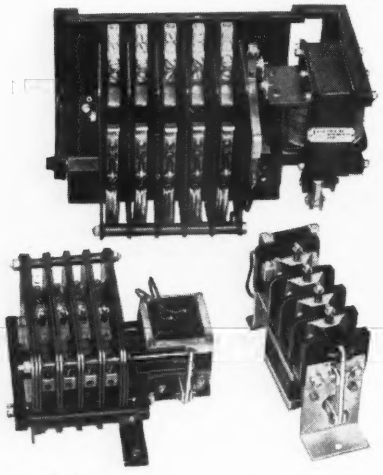

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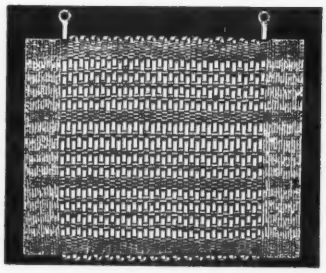

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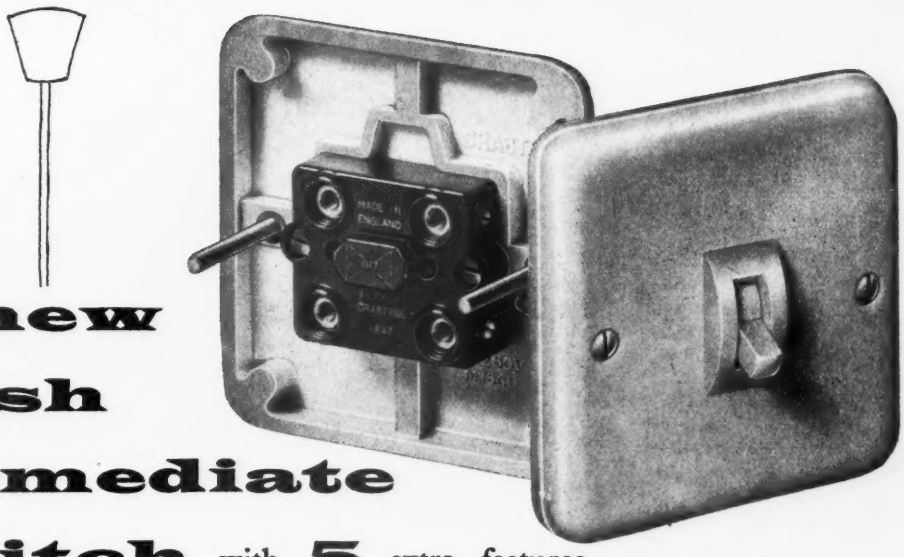
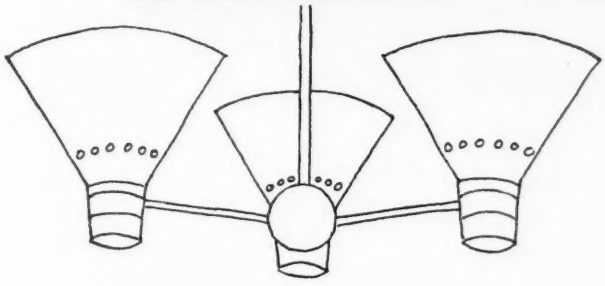
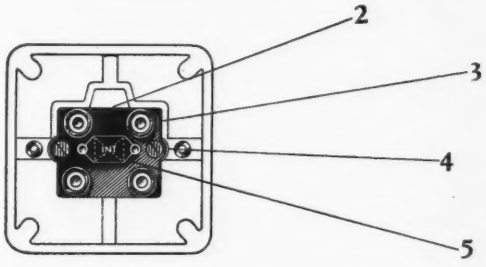
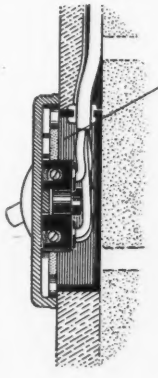


a new flush intermediate switch with 5 extra features . . .





Uniform in every respect with the popular one and two way "Lincoln" Type AC flush switches, this new Intermediate switch breaks new ground with the five unusual features detailed in the accompanying illustrations. It is, in addition, a high efficiency switch, rated at 5 amp. 250 volt AC, and capable of dealing with modern lighting loads. Listed particulars will be found in Publication No. 1190, available on request.



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2. Sealed mechanism.
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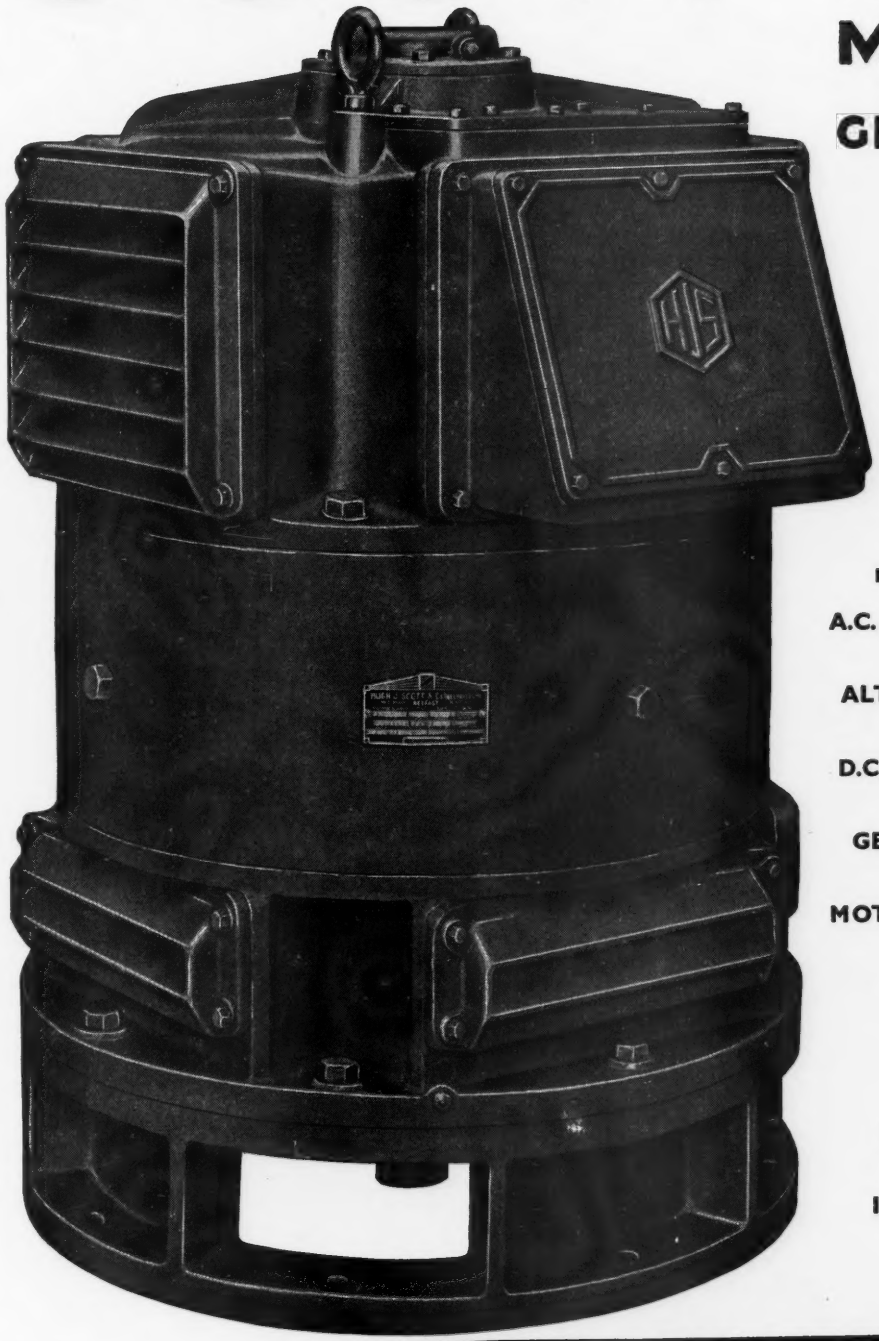

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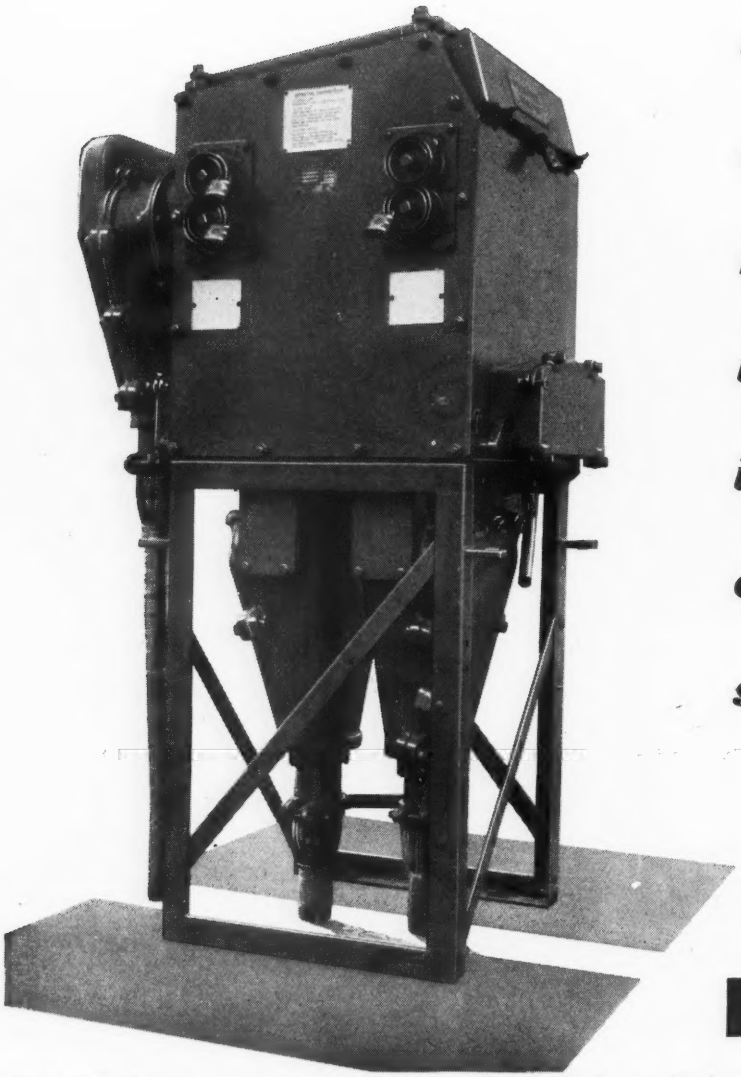

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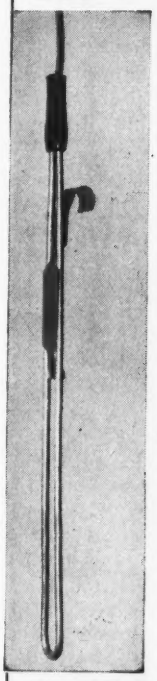

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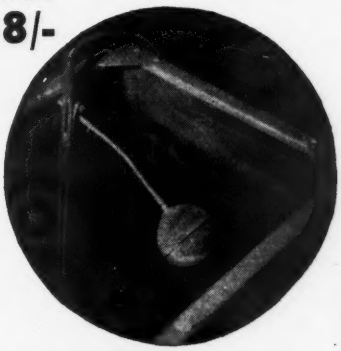

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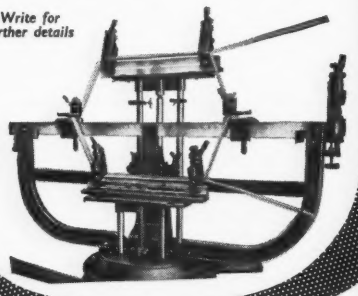

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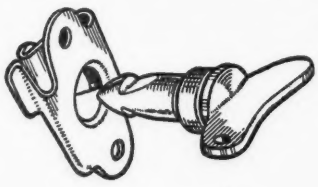

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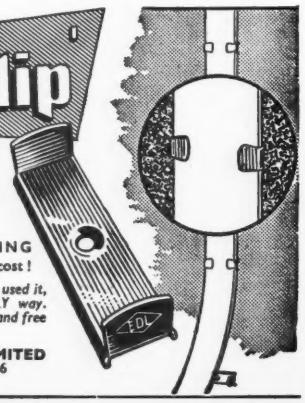

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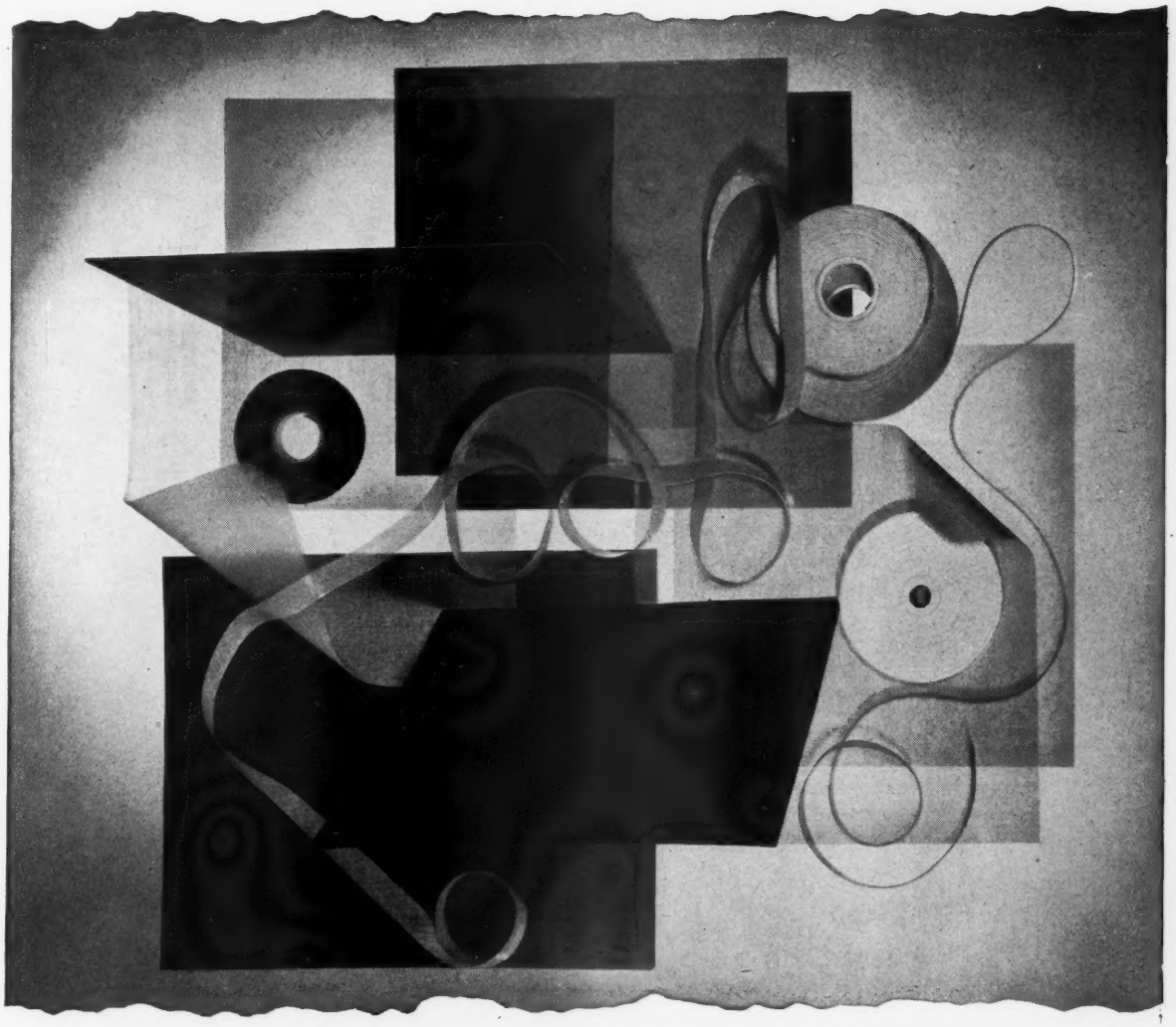

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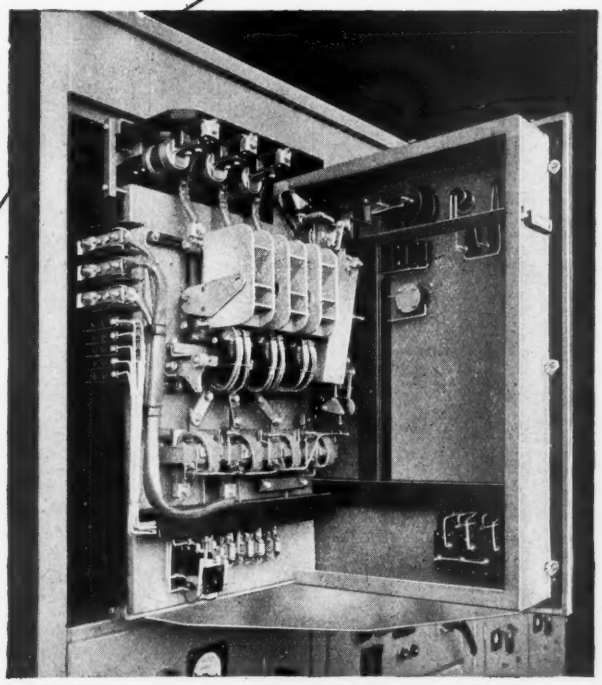

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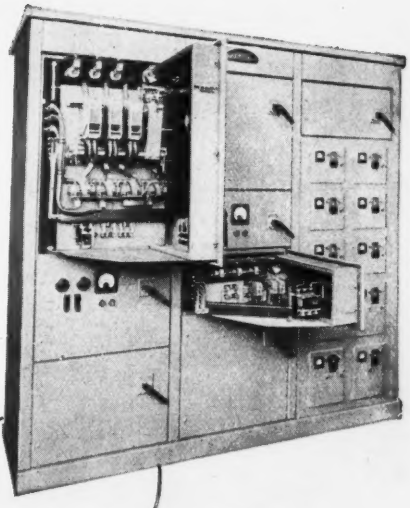

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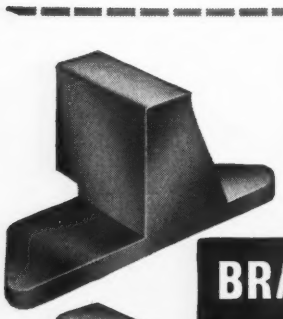

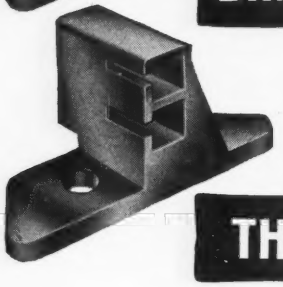

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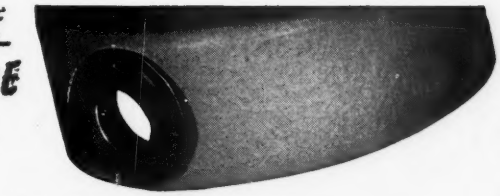

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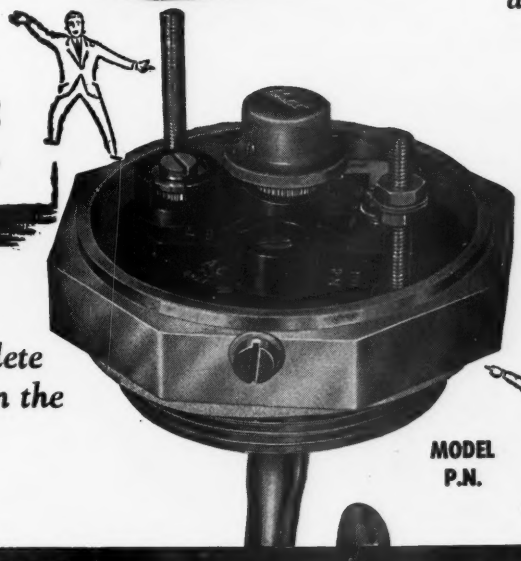

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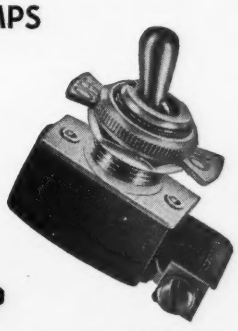

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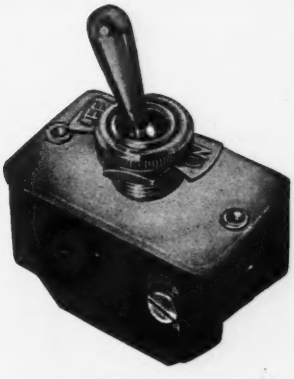

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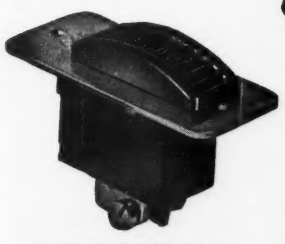

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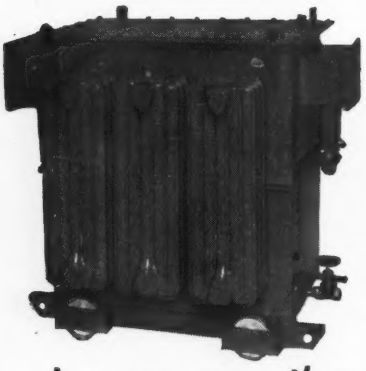

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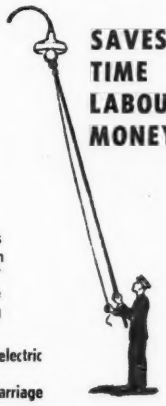

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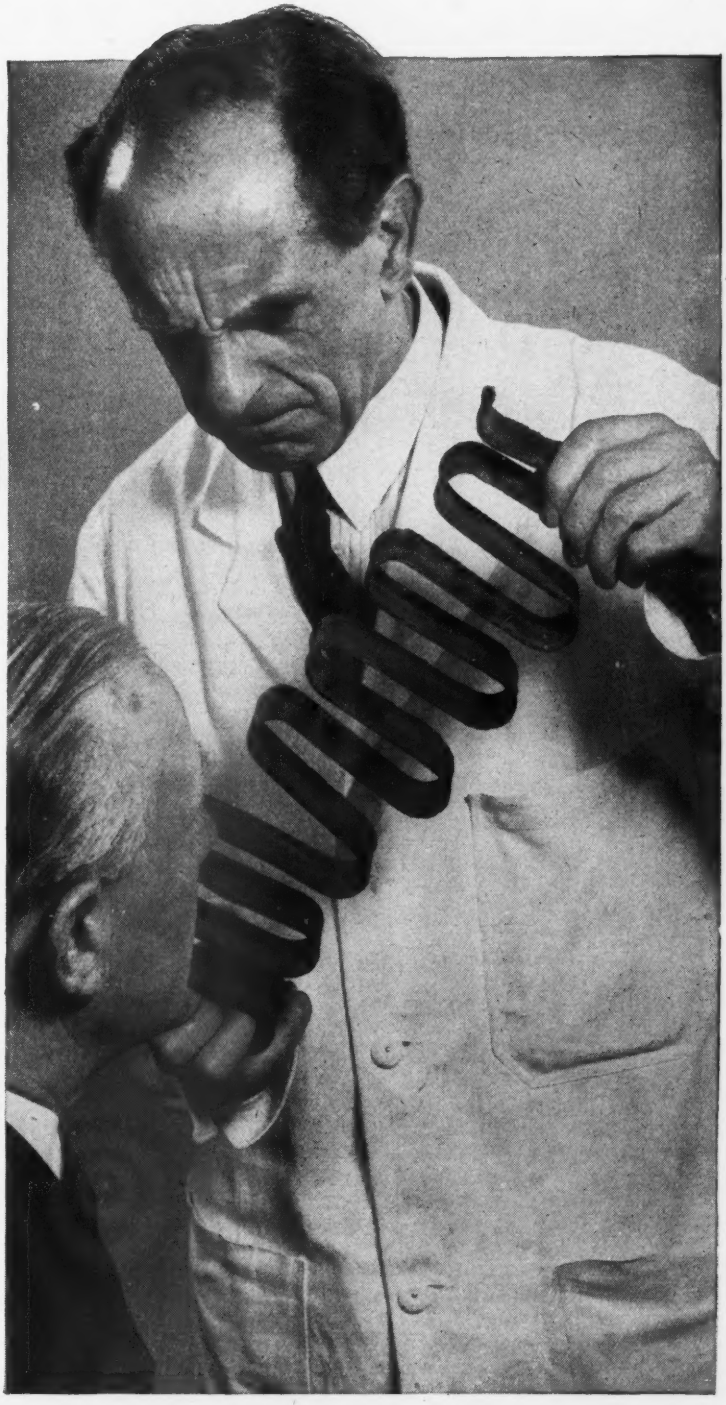

He's a quiet type normally, all wrapped up in productivity. But when his production line is brought to a standstill by the premature failure of a furnace element, in he rushes to the Buyer's Office. 'Look at this element' he says, and then it starts....

It's little use for the Buyer to protest that he only orders the elements—Mr. Finch is formidable in this mood and, of course, he's right. Correct choice of the most suitable resistance material would have ensured dependability and long life. That is why so many furnace manufacturers use one of the Brightray Alloys for their elements.

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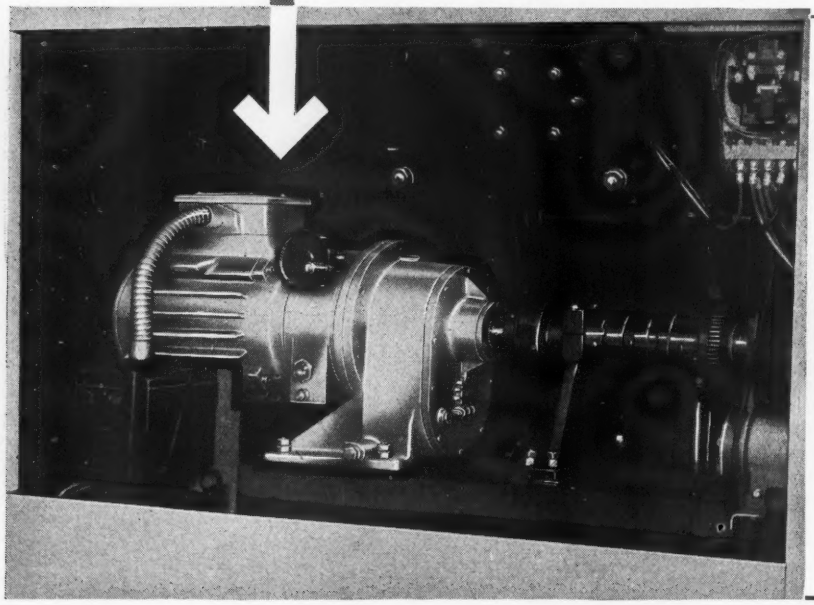

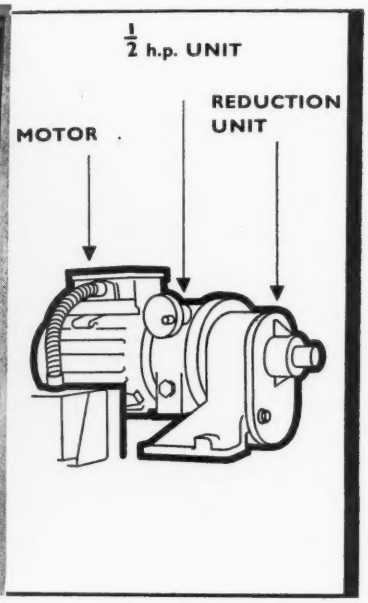

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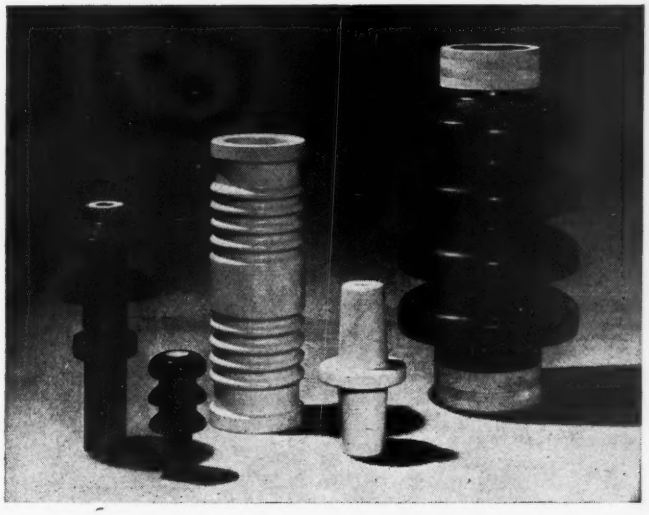

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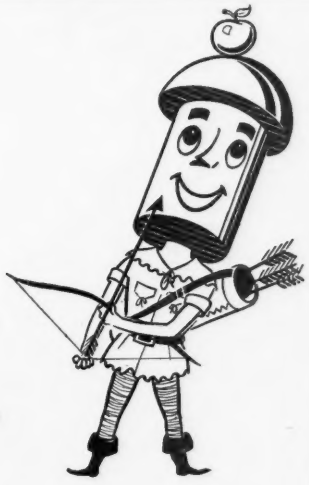

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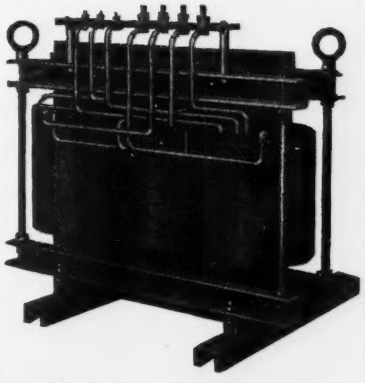

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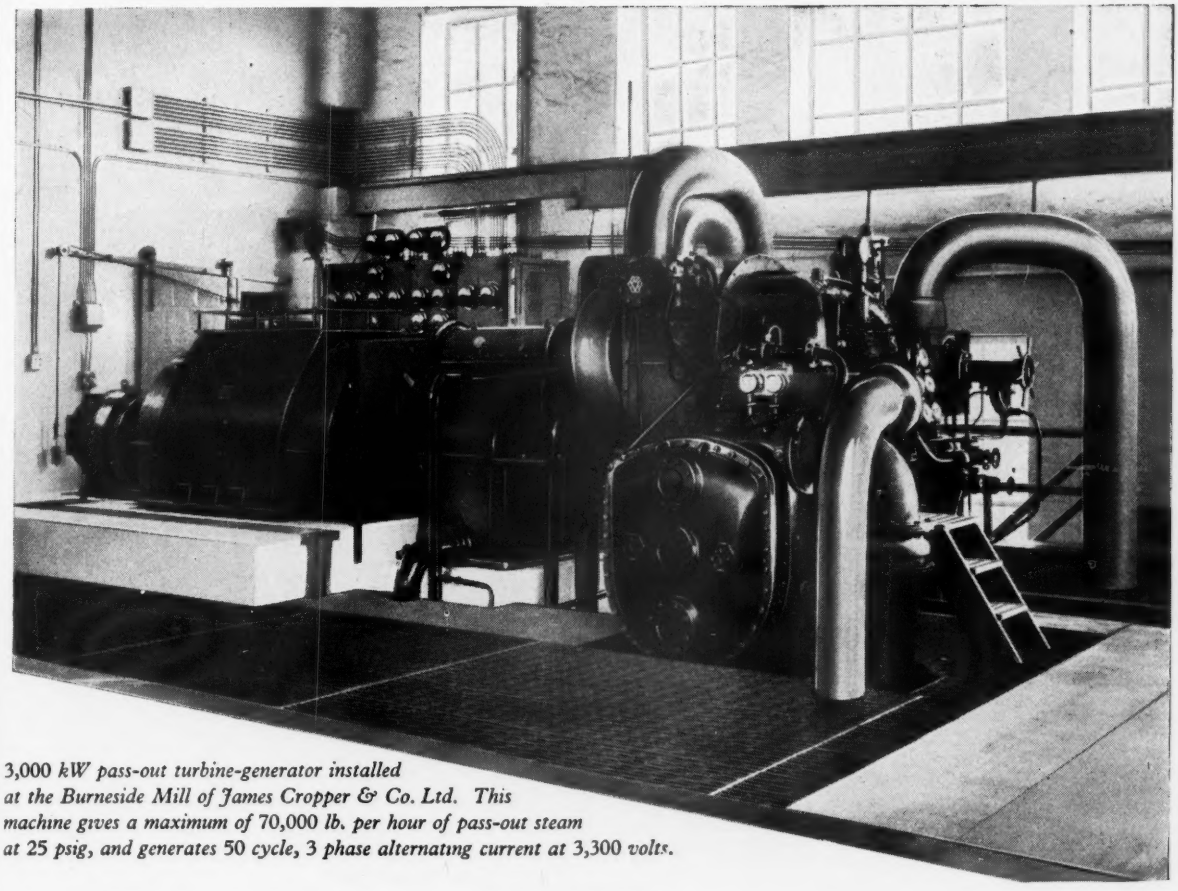

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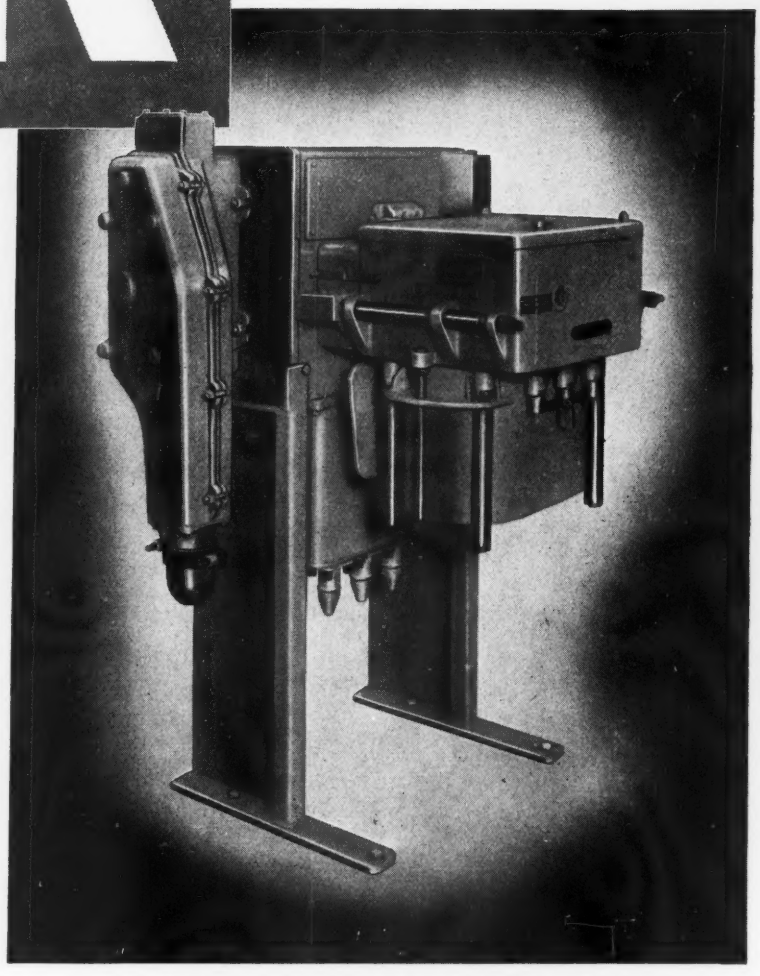

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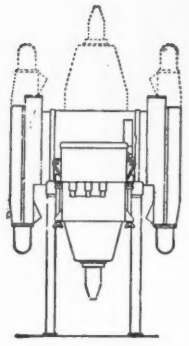

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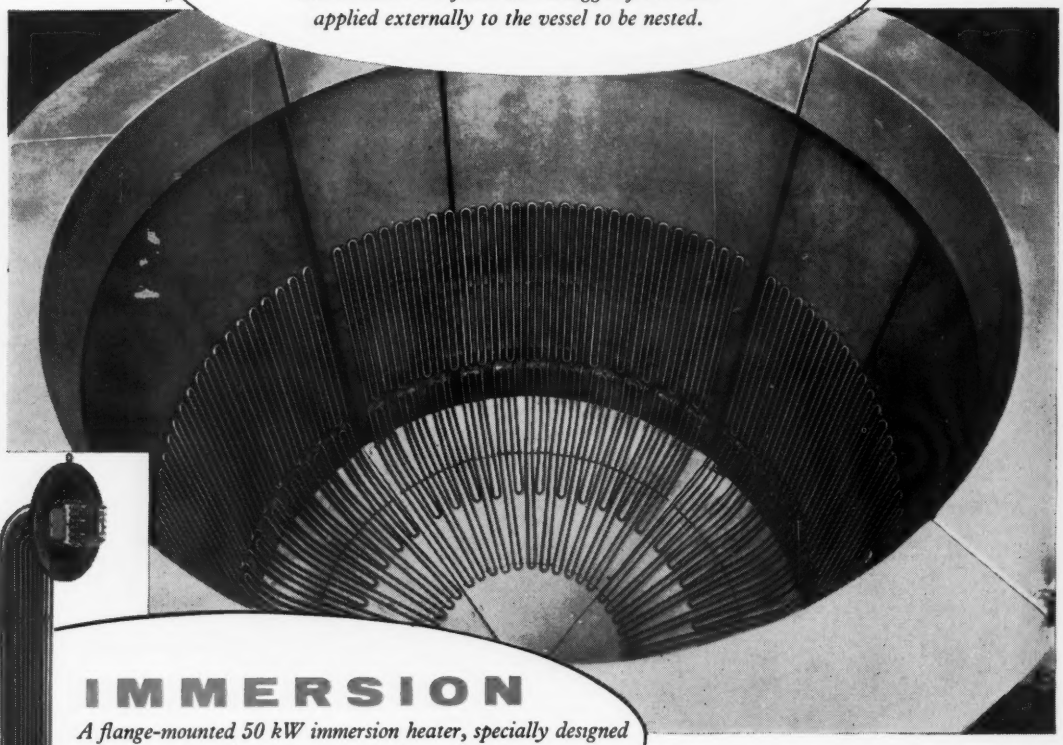

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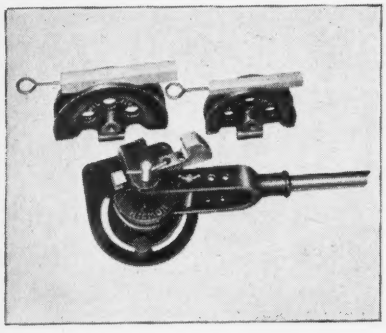

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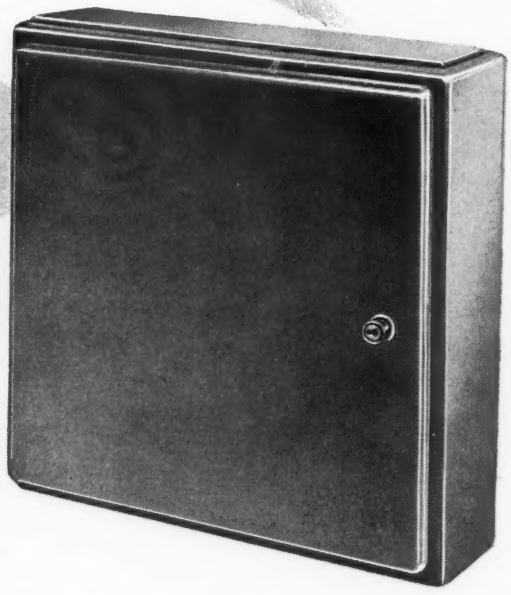

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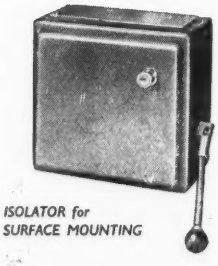

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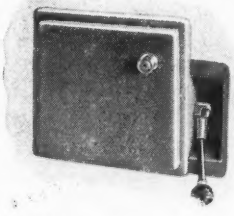

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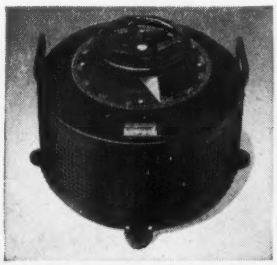

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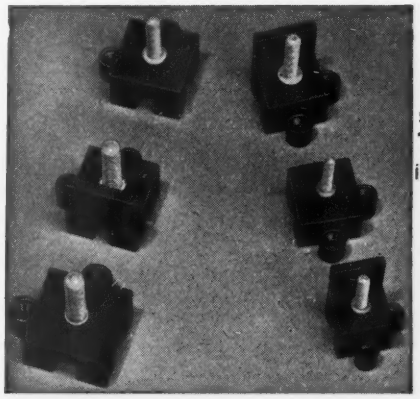

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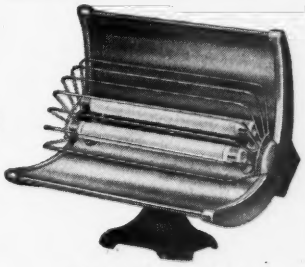

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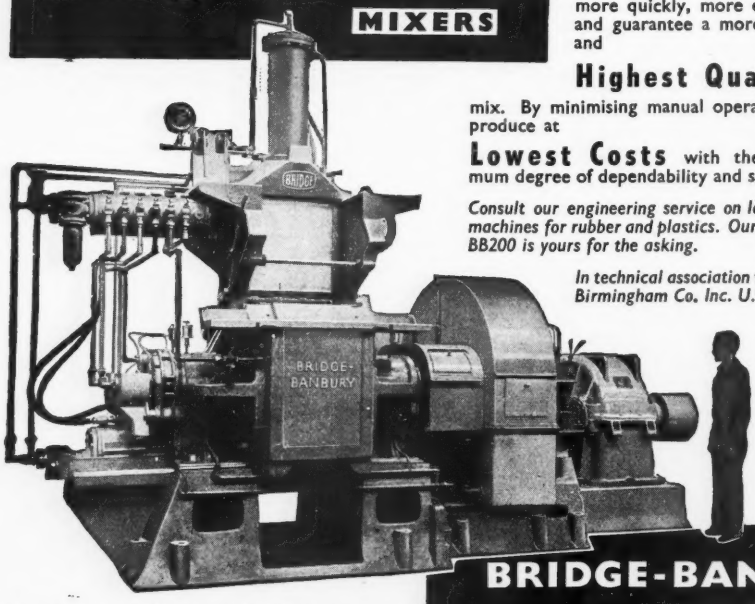

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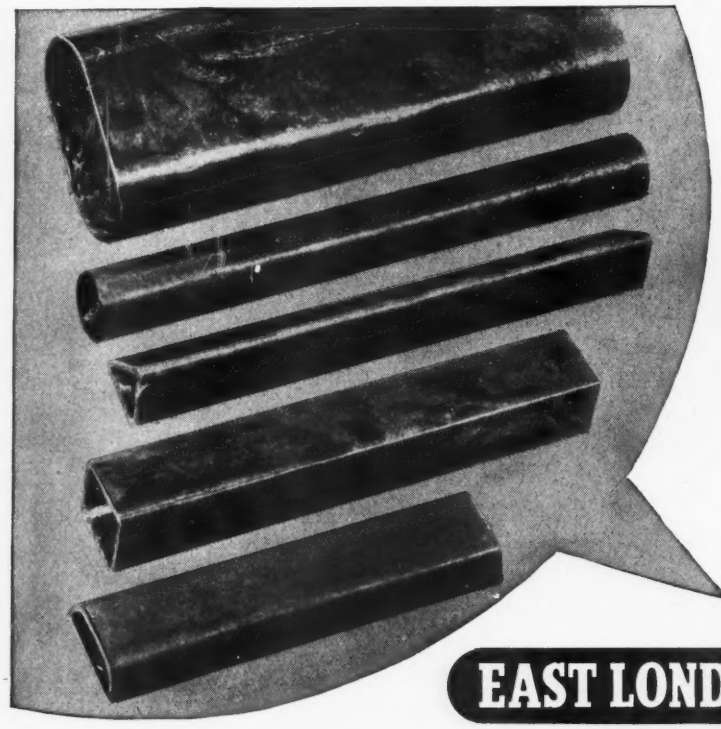

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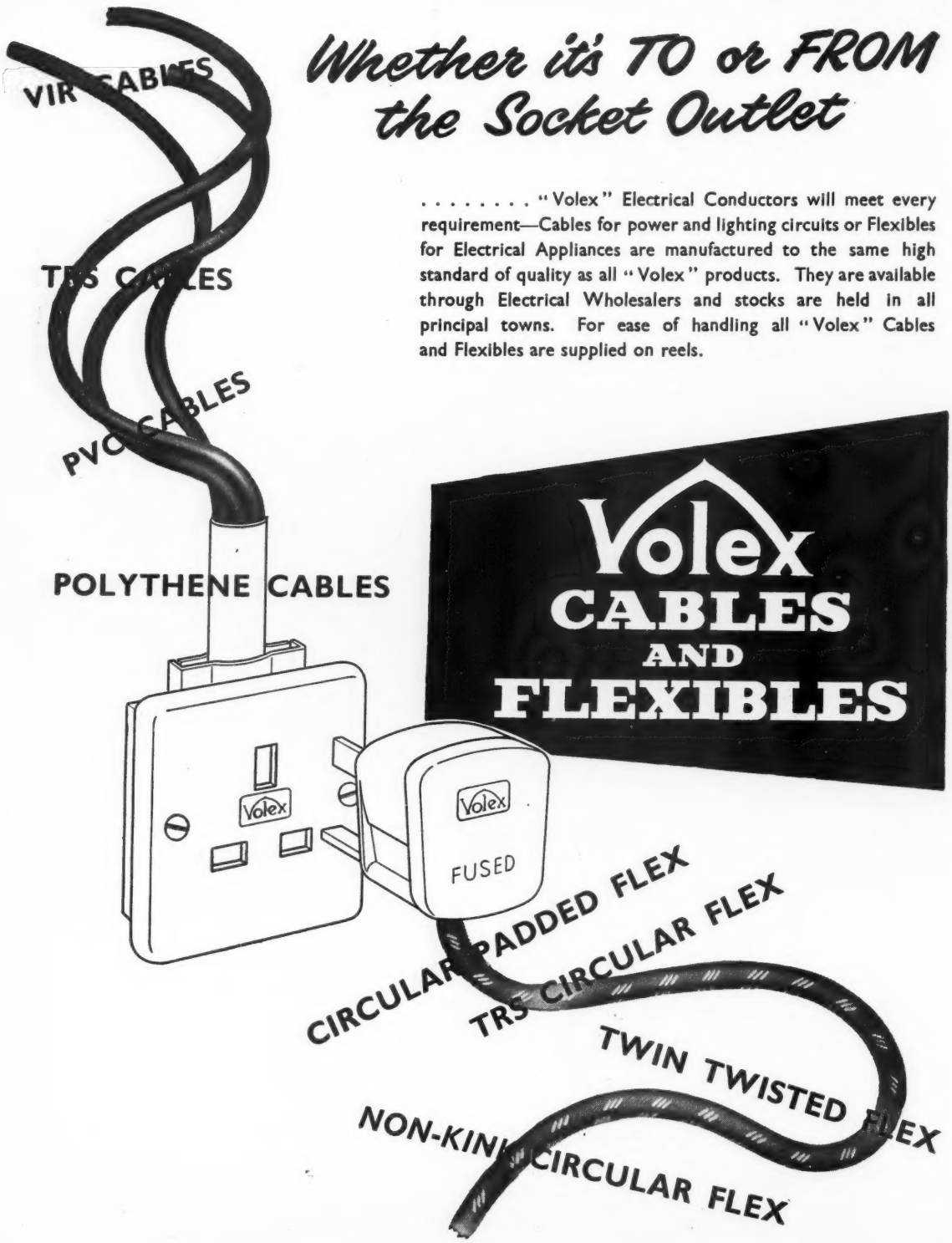

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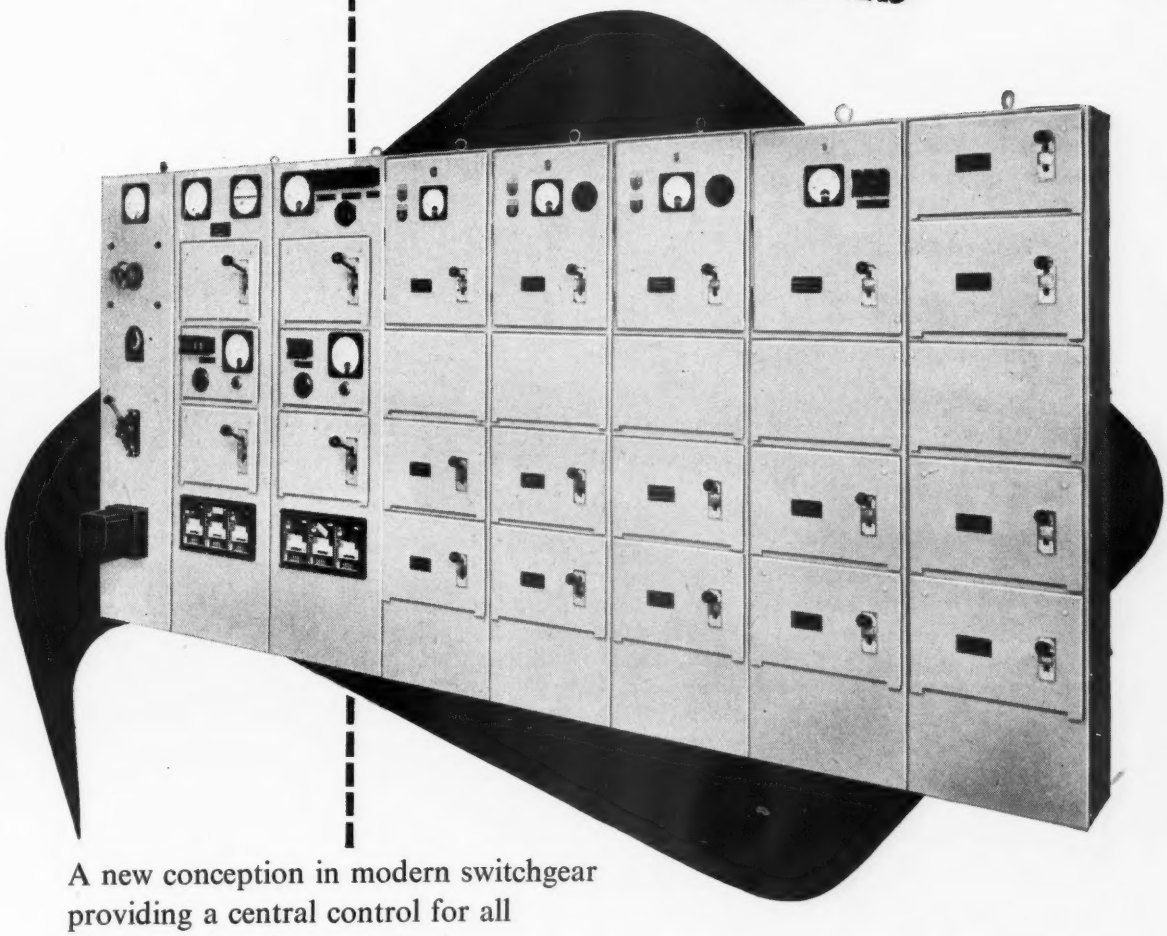

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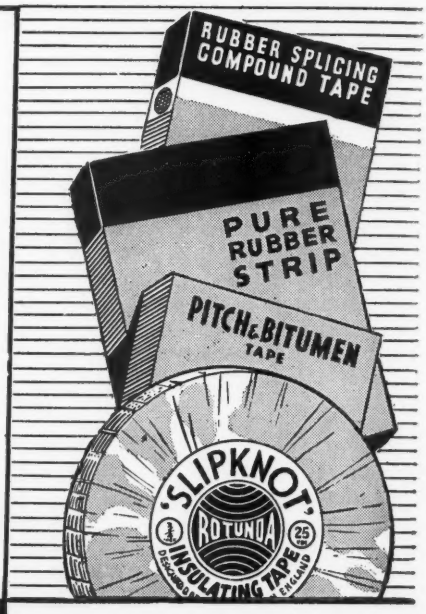

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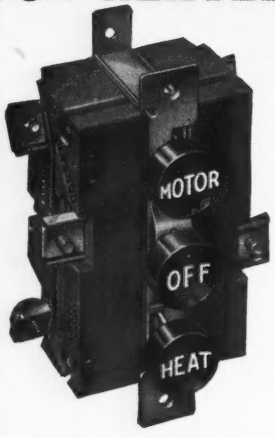

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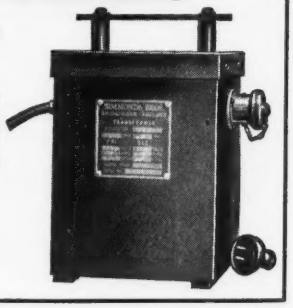

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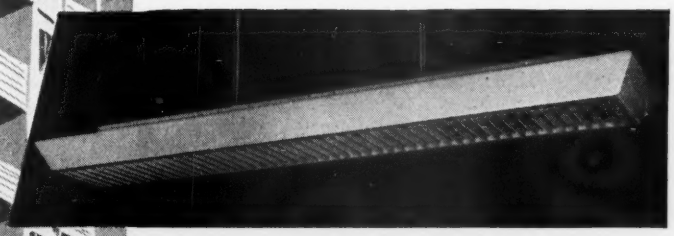
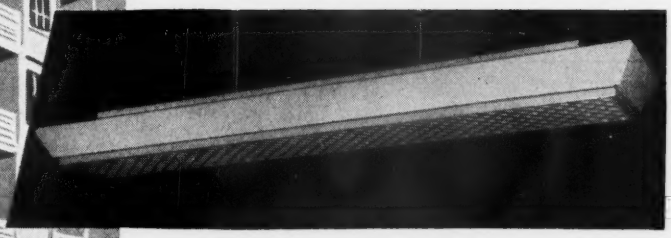


FLEET—Gear channel, body and louvre of sheet steel, stove enamelled off-white. The louvre is specially designed to show only the transverse members and has "perspex" shields at each end to conceal the lamp holders.



WANDLE—Gear channel and body of sheet steel, stove enamelled off-white. The louvre is of polystyrene.

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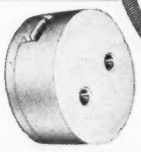
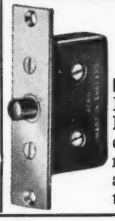


No. 8260—Bi-pole Connector (cream bakelite) for use with fluorescent tubes with bi-pin caps.



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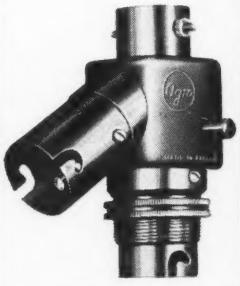

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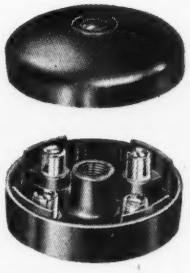

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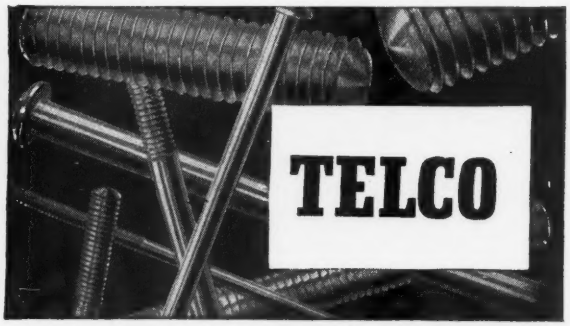

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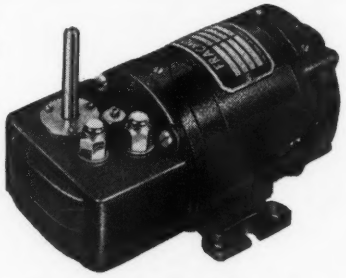

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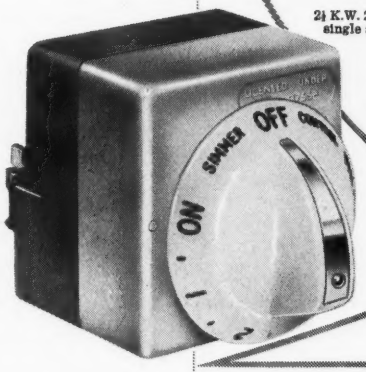

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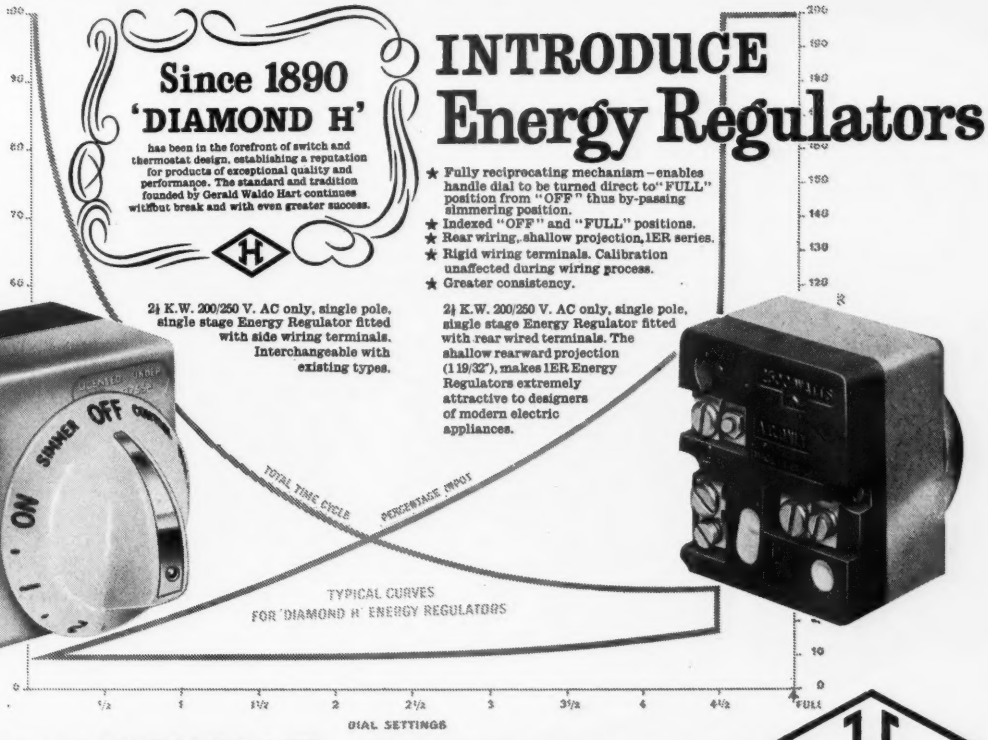

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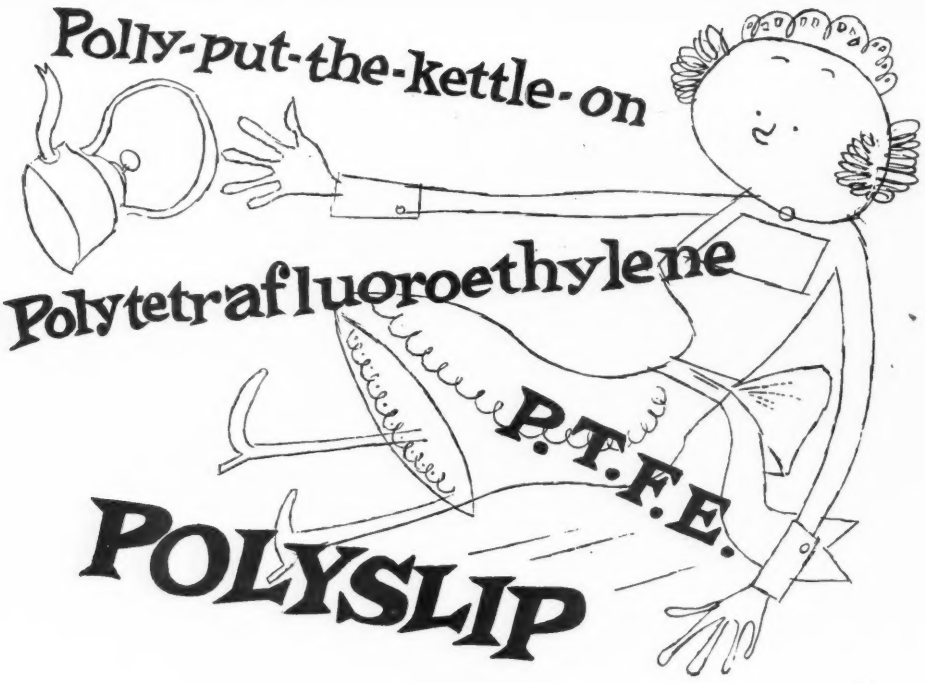

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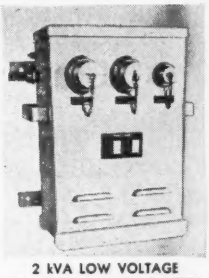

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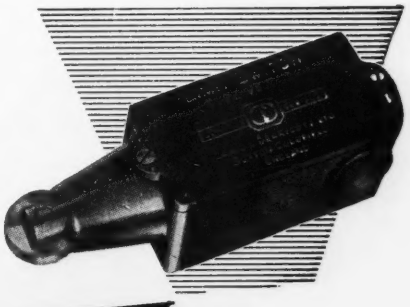

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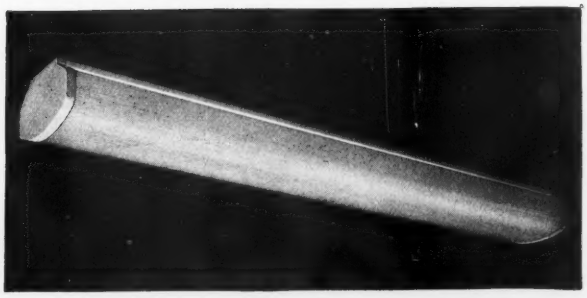

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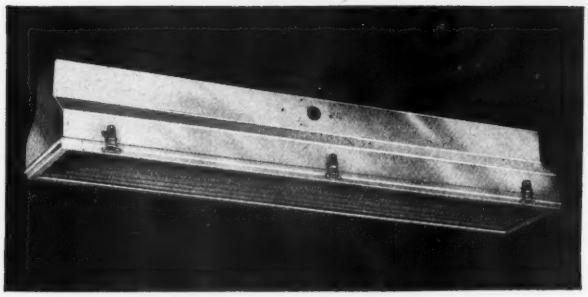

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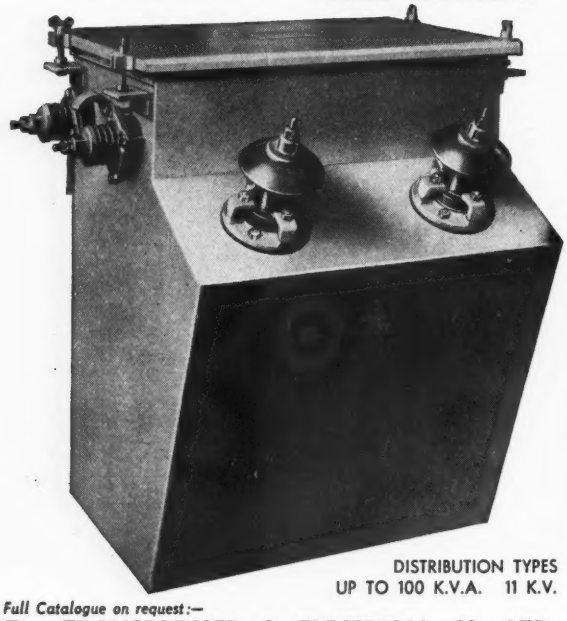

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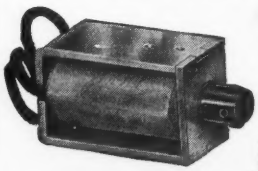

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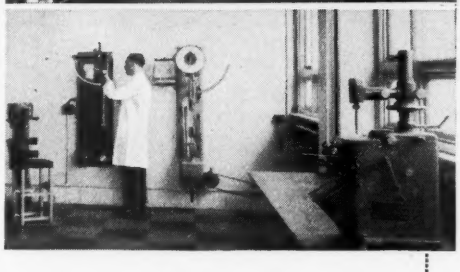

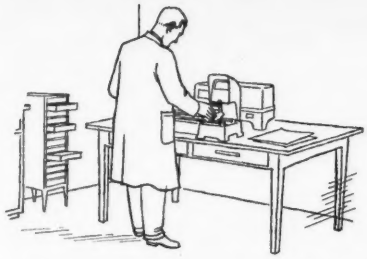

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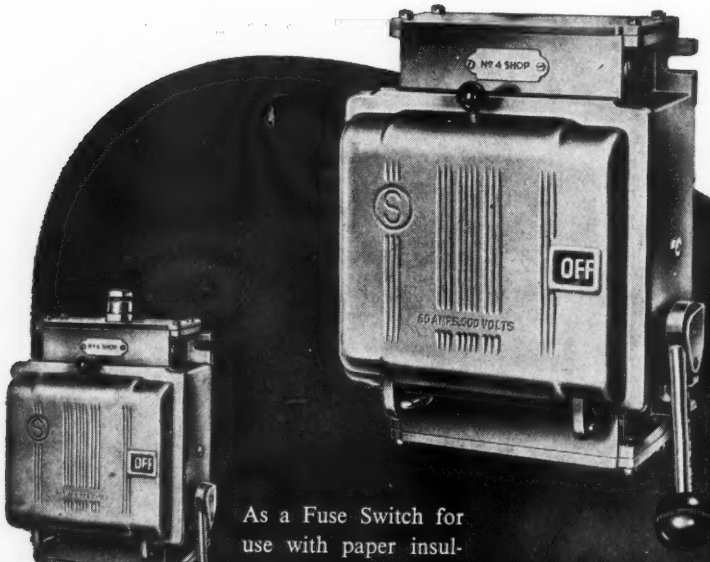

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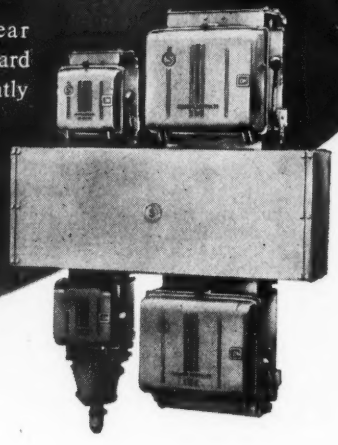

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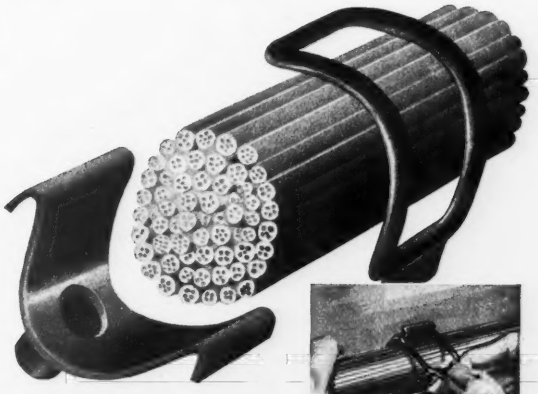
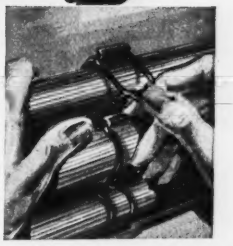
- Assured electrical and mechanical security in all conditions.
- Substantially reduces wiring costs.



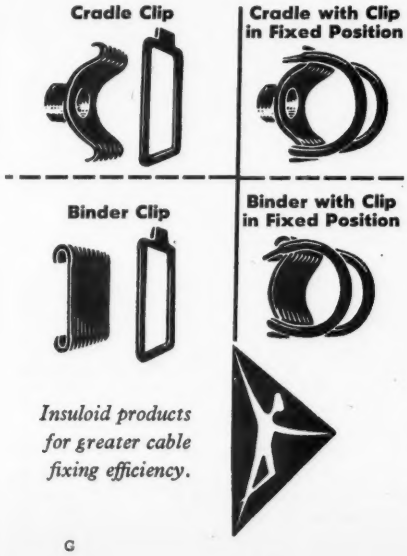


Twice as good . . . twice as quick . . . when you wire with Cradleclip !

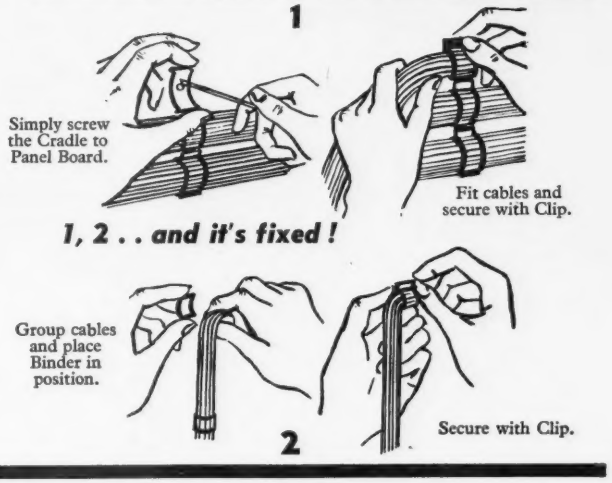
More and more progressive Companies are switching to Cradleclip...No wonder, when you consider the remarkable versatility and proved economy of the Cradleclip system. Two simple movements and Cradleclip is truly fixed, quickly, efficiently and neatly! Cradleclip, whilst being extremely simple in operation, sacrifices no point of technical efficiency and is suitable for service in all climatic conditions with a temperature range of −60° C to +100° C. Cradleclip is another Insuloid contribution to progress in electrical industry. We would be pleased to send you fully descriptive literature telling you all about the Cradleclip revolutionary wiring system on request.

And such simple components !

The Cradleclip system is compact from every viewpoint and consists of only 3 main components which are supplied in a range of sizes which provides for multi-purpose interchangeability. The illustrations below show how simply the components are used.



Insuloid products for greater cable fixing efficiency.


1
Simply screw the Cradle to Panel Board.
Fit cables and secure with Clip.
1, 2 . . and it's fixed !
Group cables and place Binder in position.
Secure with Clip.
2

find out about these other INSULOID products :-

A.S. Saddles
For time saving and greater efficiency in Wallmounted wiring.

S.A.S. Saddles
Single screw 2 point fixing for use in conjunction with standard cable racking.

Flexiguard Cable Trunking
Developed for cubicle-to-door wiring protection and speed of installation. Simple to fix and an obvious aid to wiring problems.

Ringlock Bush
A snap action, quick locking bush that will not come out after fixing. Simple finger action, instantaneous assembly for complete security in service.

NX, X & CY Clips
The well-known Insuloid range of Cable clips in nylon and P.V.C. For long service, anti-corrosive, non-chafing and very economical.

Busbar Insulation
Shrunk-on hard plastic sleeving brings immediate savings in cost, time and production with increased efficiency and safety. Provides permanent dielectric non-ageing and "non-tracking" protection.

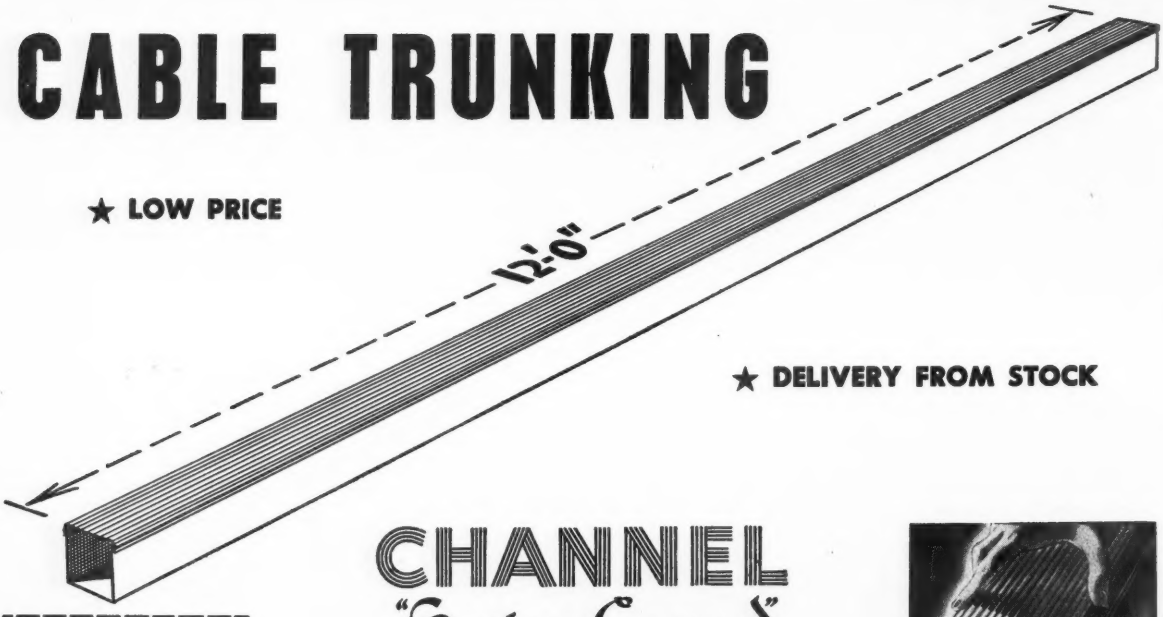
INSULOID MANUFACTURING CO. LIMITED

Sharston Works, Leastone Road, Wythenshawe, Manchester.
Tel : Wythenshawe 2842 & 3163.

G

CABLE TRUNKING

★ LOW PRICE



★ DELIVERY FROM STOCK

WRITE FOR BROCHURE No. R.A.118

CHANNEL "Spring Capped" CONDUIT

CHANNEL CONDUITS LTD., 11 VICTORIA STREET, LONDON, S.W.1. Telephone: ABBEY 2027/8

POWER TRANSFORMERS

50VA-5KVA
Single or Three Phase

JOHN DRUMMOND (Engineers) LTD.
Bellcrag Works, Dalsholm Road, GLASGOW, N.W.
Telephone: MARyhill 3315

FURSE

LIGHTNING CONDUCTORS
and Earthing Equipment

Largest Manufacturers and Exporters in Great Britain

Advisory and technical information service free — complete schemes and estimates. Illustrated literature on request.

W. J. FURSE & CO. LIMITED
33 Traffic Street (Tel. 88601-3 lines) NOTTINGHAM
Also LONDON, MANCHESTER, BIRMINGHAM, BRISTOL

If you need

a small **METAL PRESSING** for your product, why not consult us?

We specialise in light precision presswork in all metals for the Electrical Trades.

QUOTATIONS BY RETURN

BIRMINGHAM SPECIALITIES LTD.
80-81 Bath Street, Birmingham 4. *Phone: CENTRAL 2492*

Aeroflex

ENERGY LIMITING

CARTRIDGE FUSES TO CLASS P

This new range of Aeroflex Fuses (AD and FC type) Category 440 AC5 Class P - is fully interchangeable with the former patterns and is now supplied in all listed Fluvent Switch and Fusegear. They offer refinements in performance, primarily due to the following factors:-

TECHNICAL DATA

Publication CF2 deals extensively with the subject and affords interesting data. A copy will be forwarded gladly to enquirers and students.

These characteristics are extensively detailed in this new publication, CF2, which reproduces actual oscillograms obtained during ASTA tests.

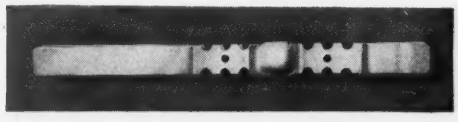
(1) The proved Breaking Capacity is raised from 33 to 46 K.A.

(2) The Energy Limiting is uniformly developed throughout the range.

(3) The fusing Factor is standardised at 1.25 throughout the range.

(4) The cartridge cases are ceramic instead of fibre.

(5) The end caps are fixed instead of being detachable as in the AF pattern, and re-wiring is normally carried out by returning blown cartridge fuse-links to the factory and not on site.



★ *The latest types of Aeroflex fuse element as employed in the AD and FC type Energy Limiting Fuses.*

Rewireability : Fuse Links are not discarded when blown —they can be returned for prompt replacements under our rewiring service scheme.

Parmiter Hope & Sugden Ltd

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12

London : 34 Victoria Street, S.W.1. *Glasgow :* 5 Somerset Place, C.3. *Birmingham :* 39/41 Carrs Lane, 4.

dm PH83

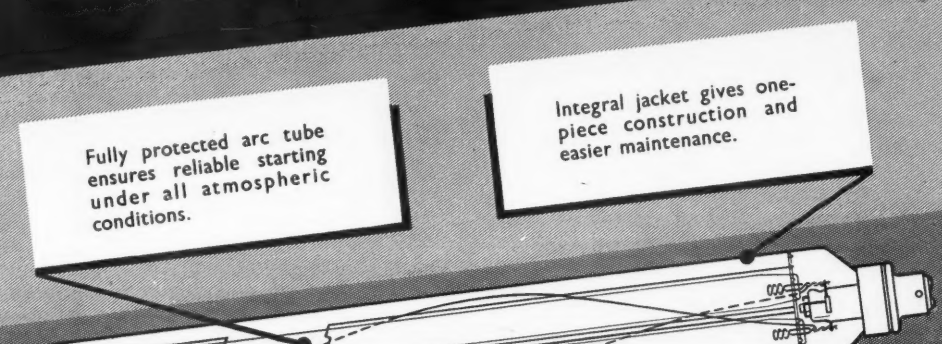
Osram

Integral Sodium Lamps

with these unique advantages . . .

Fully protected arc tube ensures reliable starting under all atmospheric conditions.

Integral jacket gives one-piece construction and easier maintenance.



Specially designed arc tube support yields a rugged, shock resistant lamp.

Glass arc tube sleeves cut heat losses for maximum light output.

Conceived, developed and manufactured entirely within the Osram organization

More and more Osram Integral Sodium lamps are being demanded by engineers who realise the economies and advantages that can be achieved by their use.

Osram for Progress and Superb Quality

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

SADDLEWORTH URBAN DISTRICT COUNCIL

Street Lighting

TENDERS are invited for the installation of 140-watt Sodium Discharge Lighting on a section of the Liverpool-Leeds-Hull Trunk Road, A.62.

The scheme provides for Group A lighting of the Trunk Road A.62 between a point approximately 40 yards east of Heywood Lane Junction, Austerlands, along route A.62 to a point approximately 37 yards east of Platting Road and Doctor Lane Junction, Scouthead, within the boundary of the Saddleworth Urban District.

The proposed installation will comprise 37 lighting points with totally enclosed lanterns, mounted on reinforced concrete narrow base type columns with a mounting height of 25 ft., with all necessary wiring and control equipment.

The work is divided into two contracts as follows:—

Tender No. 1: The supply of lanterns, lamps and auxiliary equipment.

Tender No. 2: The supply, erection and wiring of concrete columns and brackets, and the installation of lanterns, lamps and auxiliary equipment.

Forms of tender, conditions of contract, specification and bills of quantities can be obtained on application to Mr. G. H. Booth, Lighting Superintendent, Council Offices, Uppermill, near Oldham.

Tenders, in plain sealed envelopes, which must not bear any name or mark indicating the sender, endorsed "Tender No. 1: Supply of Lanterns, Lamps and Auxiliary Equipment," or "Tender No. 2: Supply of Concrete Column and Erection," as the case may be, addressed to the Clerk of the Council, Council Offices, Uppermill, near Oldham, to be delivered on or before 12 noon on Saturday, 18th January, 1958.

The Council do not bind themselves to accept the lowest or any tender.

T. NUTTALL,
Clerk of the Council.

Council Offices,
Uppermill,
Near Oldham. 1709

FRIERN BARNET URBAN DISTRICT COUNCIL

Renewal of and Additions to Electrical Installation to approximately 100 Council Houses

TENDERS are invited from electrical contractors for the above work. Documents may be obtained from E. H. Start, A.M.I.C.E., A.M.I.Mun.E., Engineer and Surveyor, Town Hall, London, N.11, and must be returned to the undersigned not later than 10 a.m. on Friday, 3rd January, 1958.

E. G. HUBBARD,
Clerk of the Council.

Town Hall,
London, N.11. 1682

INDIA STORE DEPARTMENT

THE Director General, India Store Department, Government Building, Bromyard Avenue, London, W.3, invites tenders for the supply of Unit Rectifier No. 19.

Forms of tender, which are returnable by 27th January, 1958, may be purchased at the above address at the cost of 10s., which is not returnable.

Reference No. 3623/57/ET/BNG must be quoted on all applications. 1701

BETHESDA URBAN DISTRICT COUNCIL

Public Lighting, Group A

TENDERS are invited for the supply and erection of 34 Sodium Discharge Lamps, including the supply and erection of 20 new steel columns and 14 brackets to existing poles, together with all ancillary equipment.

Tender documents may be obtained from the Council's Surveyor, Council Offices, Bethesda, on payment of two guineas (made payable to the Bethesda Urban District Council), which will be returned on receipt of a bona fide tender.

Tenders, in plain sealed envelopes, endorsed "Tender for Public Lighting," must be delivered to the undersigned not later than noon on Tuesday, 31st December, 1957.

The Council do not bind themselves to accept the lowest or any tender.

E. GRIFFITH,
Clerk to the Council.

Council Offices,
High Street, Bethesda.
Caernarvonshire. 1708

BOROUGH OF ROMFORD

Squirrels Heath School, Salisbury Road

TENDERS are invited for the supply and installation of Electrical Equipment in connection with the modernisation of the electric lighting at this school.

The specification and form of tender may be obtained from the Borough Surveyor, Town Hall, Romford, on payment of £2 2s. (cheque), which will be refunded on receipt of a bona fide tender and all documents.

Tenders in envelopes provided must be delivered to me by Tuesday, 7th January, 1958.

JOHN E. SYMONS,
Town Clerk.

Town Hall,
Romford.
4th December, 1957. 1669

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Sloy/Killin 132-kV Transmission Line, Stringing of Second Circuit

TENDERS are invited for the supply, delivery and erection of materials for the second circuit of the DC1 Steel Tower 132-kV Transmission Line between Sloy and Killin.

Copies of the tender document may be obtained on application to Chief Electrical and Mechanical Engineer, North of Scotland Hydro-Electric Board, 16, Rothesay Terrace, Edinburgh. Applications should be accompanied by a deposit of two guineas (returnable). 1700

SITUATIONS VACANT

INSPECTING ENGINEER (ELECTRICAL)

required in Manchester by consulting engineers to assist with inspection and testing supervision of control gear and other light electrical equipment, including instrumentation, metering, communications and electronics as applied to thermal, nuclear and hydro-electric generating stations and transmission systems.

Applicants must either have had appropriate experience or have the capacity to acquire it, and they must also possess I.E.E. Corporate Membership or other equivalent or prospective qualifications.

Salary and prospects will be commensurate with the character of the appointment.

Application forms should be applied for in writing to — Staff Appointments, Kennedy & Donkin, 813a, Wilmslow Road, Didsbury, Manchester, 20. 1692

CHRISTMAS

ADVERTISEMENTS for the issue of 27th December have now closed for press.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

CENTRAL ELECTRICITY AUTHORITY

South Eastern Division

Littlebrook Power Station

ASSISTANT SHIFT CHARGE ENGINEER. Experience of operation of power station plant is necessary, and possession of H.N.C. preferred. Salary Class L, Grade 9, £1,115-£1,190 per annum, including London allowance plus 10% shift allowance.

Croydon "B" Power Station

ASSISTANT ENGINEER (Control). The post involves shift working, and applicants should have experience of control room duties. The possession of technical qualifications will be an advantage. Salary Class J, Grade 13, £780-£825 per annum, including London allowance plus 10% shift allowance.

Technical Dept., Croydon District

FOURTH ASSISTANT ENGINEER required in the Croydon District (covering approximately the county of Surrey). Applicants must have H.N.C. or equivalent qualifications. Work comprises the commissioning of major electrical plant in Grid substation and generating stations, investigating faults therein, maintaining of associated protective gear, etc. Salary Class AX/DX, Grade 8, £750-£960 per annum, including London allowance.

N.J.B. conditions of service.

Applications, giving details of education, age, present position, experience, etc., should be sent to the Station Superintendent, according to location of vacancy, at either Littlebrook Power Station, near Dartford, Kent, or Croydon "B" Power Station, Beddington Farm Road, Croydon, and in respect of the Technical Department appointment to the Establishments Officer, Central Electricity House, Lower Ham Rd., Kingston-on-Thames, so as to arrive by 27th December, 1957, quoting reference (205). 1685

EAST MIDLANDS ELECTRICITY BOARD

Second Assistant District Engineer, Wellingborough District, Northamptonshire Sub-Area

APPLICATIONS are invited from suitably qualified and experienced engineers for the appointment of SECOND ASSISTANT DISTRICT ENGINEER in the Wellingborough District of the Northamptonshire Sub-Area.

The salary and conditions of the appointment will be in accordance with the National Joint Board Agreement, Class E, Grade 7 (£835-£880 per annum) and a rented house will be available.

The duties of the appointment will consist of assisting in the construction, maintenance and operation of H.V. and L.V. underground and overhead networks, and preference will be given to applicants having a technical qualification equivalent at least to the Higher National Certificate in Electrical Engineering.

The successful candidate must be able to drive a motor vehicle and he will be required to undertake standby duties.

Applications stating age, education, qualifications, experience, present position and salary should be forwarded to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, to reach him within fourteen days of the issue of this advertisement. 1711

Situations Vacant (continued)

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

BOILER HOUSE SHIFT CHARGE ENGINEER, NORTH WILFORD POWER STATION, NOTTINGHAM (Vacancy No. 221/57/ER).

Applicants should have had a sound technical training, good general engineering experience, and a knowledge of the control and operation of large pulverised fuel boilers and associated equipment. Preference will be given to candidates who are in possession of technical qualifications admitting to Corporate Membership of a recognised professional institution.

Salary will be in accordance with Class K, Grade 9 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 1st January, 1958.

GENERAL ASSISTANT ENGINEERS, WILLINGTON, STAYTHORPE AND OTHER LARGE GENERATING STATIONS (Vacancy No. 220/57/ER).

Applications are invited from suitably qualified young men who are interested in generating station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern generating station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £540-£730 per annum.

Closing date for receipt of applications, 1st January, 1958.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., CASTLE DONINGTON POWER STATION SITE (Vacancy No. 225/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

THIRD ASSISTANT ENGINEER (Civil), GENERATION (Construction) DEPT., SPONDON "H" POWER STATION (Vacancy No. 224/57/ER).

Preference will be given to applicants who hold a degree in Civil Engineering, are Corporate Members of the Institution of Civil Engineers, or possess equivalent qualifications.

Applicants should have had some experience in the design and construction of heavy foundations, river works, structures in reinforced concrete and steel, and other civil engineering works associated with the design and construction of power stations. Experience in assisting in the preparation of specifications, bills of quantities and estimates will be an advantage. The successful applicant will be required to act as Assistant to the Resident Civil Engineer on Site at Spondon "H" Power Station.

Salary will be in accordance with Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

SECOND ASSISTANT ENGINEER, GENERATION (Operation) DEPT., DIVISIONAL HEADQUARTERS (Vacancy No. 223/57/ER).

Applicants should have received a sound practical and theoretical training in all aspects of steam plant engineering, experience in operation and efficiency work in large modern power stations, and should have reached at least Higher National Certificate standard.

Salary will be within Class AX/EX, Grade 4 (£1,145-£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

The appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

11th December, 1957. 1688

ENGLISH ELECTRIC

THE Marine Department of English Electric, Rugby, has a vacancy for an

ELECTRICAL ENGINEER

with a good knowledge of medium range electrical machines and switchgear.

Applicants should be between 26 and 30, preferably single, and be capable of preparing electrical layouts for marine applications.

Write giving full details to—

Dept. Central Personnel Services,

Marconi House,

336/7, Strand, London, W.C.2,

quoting

Ref. ER.1118A.

1670

NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER, SUB-AREA CONSUMERS' ENGINEER'S DEPT., MANCHESTER.

Applicants should be qualified to advise consumers on the application of electricity to industrial processes, especially in the engineering, chemical and textile industries. Some knowledge of space and process heating is desirable.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,325 × £30 to £1,415, Grade M.7. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Secretary, No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 4th January, 1958.

SECOND ASSISTANT ENGINEER, SUB-AREA CONSUMERS' ENGINEER'S DEPT., BOLTON.

Applicants should have experience in the utilisation of electricity in industry, with particular reference to the textile, mining, engineering and chemical industries, change-over from D.C. to A.C., and public lighting.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,235 × £30 to £1,325 per annum, Grade L.7. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, by 4th January, 1958. 1683

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

EAST MIDLANDS ELECTRICITY BOARD

(a) Fourth Assistant Engineer (Construction), Derby & Burton Sub-Area Headquarters

(b) General Assistant Engineer (Operation and Maintenance), Derby and Burton Sub-Area Headquarters

(c) Fourth Assistant District Engineer (Planning), Derby District

APPLICATIONS are invited for the above appointments in the Derby and Burton Sub-Area.

The duties of post (a) will consist of assisting in the construction of H.V. and L.V. overhead and underground systems, including substations; post (b) will consist of assisting in the operation of H.V. and L.V. underground and overhead systems; and post (c) will consist of assisting with the planning and survey of underground and overhead distribution systems up to and including 11 kV.

The salaries and conditions of the appointments will be in accordance with the National Joint Board Agreement as follows :—

(a) Fourth Assistant Engineer (Construction), Sub-Area Headquarters, Class J, Grade 12 (£790 × £15 to £835 p.a.).

(b) General Assistant Engineer (Operation and Maintenance), Sub-Area Headquarters, Class J, Grade 14 (£685 × £15 to £730 per annum).

(c) Fourth Assistant District Engineer (Planning), Derby District, Class G, Grade 11 (£740 × £15 to £785 p.a.).

Applications stating age, qualifications, experience, present position and salary should be forwarded to the Manager, Derby and Burton Sub-Area, 36, Full Street, Derby, so as to reach him within fourteen days of the issue of this advertisement. 1712

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Northmet Sub-Area

HEADQUARTERS, LONDON, N.14.

FOURTH ASSISTANT ENGINEER, Sub-Area Construction Department (Ref. 768) (159/57.R).

Candidates should have had a sound technical training and be suitably experienced in the installation of underground cables both by direct and contract labour; in addition they should be capable of testing, commissioning and fault location on cable systems up to and including 33 kV.

Salary N.J.B. Class M, Grade 12 (£935-£995) plus London allowance.

Apply by letter to C. C. Hill, B.Sc.(Eng.), M.I.E., M.I.Mech.E., Manager Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, by 30th December, 1957.

HERTFORD DISTRICT.

FOURTH ASSISTANT ENGINEER (Ref. 721) (80/57.R).

Candidates should have had a sound technical training and suitable experience in the planning, construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class F, Grade 11 (£685-£730).

Apply by letter to W. H. Hatton-Ward, Assoc.I.E.E., Manager Eastern Electricity Board, Bridgefoot, Ware, Herts., by 23rd December, 1957. 1706

Applications are invited by

THE BENJAMIN ELECTRIC LTD.

for a

DESIGNER OF INDUSTRIAL LIGHTING EQUIPMENT.

Knowledge of fabricating techniques, finishes, lamps and control gear desirable, but initiative and ideas equally important.

Apply Chief Technical Engineer, Brantwood Works, Tottenham, London, N.17.

177

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

Wolverhampton and District Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Cannock).

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable. Salary £740/£785 per annum (N.J.B. Grade E.9).

SECOND ASSISTANT DISTRICT ENGINEER (Walsall).

Applicants should have had a sound technical training and wide experience in all branches of distribution work, including the construction, maintenance and operation of substations, H.V. and L.V. systems, D.C. traction supplies. Technical qualifications desirable. Salary £935/£995 per annum (N.J.B. Grade G.7).

Apply by letter, within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. D. Holt, Sub-Area Manager, Midlands Electricity Board, 83, Darlington Street, Wolverhampton.

Worcester and District Sub-Area

WAYLEAVE OFFICER (Redditch/Bromsgrove).

Duties include surveying and plotting of routes and assisting in the negotiation and preparation of wayleave agreements, etc. Salary £500/£600 per annum, N.J.C. Grade 1.

Apply by letter, within fourteen days, stating age, present employment and details of experience, to District Manager, Midlands Electricity Board, Smallwood Street, Redditch.

A. STEPHENS,
Secretary. 1707

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Crawley and Horsham District.

Salary £885-£930 per annum under N.J.B. Class E, Grade 6. Superannuable.

Applicants should be suitably qualified engineers and have considerable experience in commercial, industrial and domestic development, including floor warming. Applicants should have a thorough knowledge of sales organisation, including showroom demonstrations and lectures.

Applications, naming two referees, on forms from L. J. Simmons, M.I.E.E., A.M.I.I.A., District Manager, SEEBOARD, 32/40, North Street, Horsham, Sussex, by 6th January, 1958.

ASSISTANT DISTRICT COMMERCIAL ENGINEER, Herne Bay/Canterbury District.

Salary £790 × £15 to £835 per annum under N.J.B. Class E.8. Superannuable.

Applicants must hold the National Certificate in Electrical Engineering or its equivalent, and have had considerable experience in a District commercial department, including the preparation of specifications and estimates for domestic, commercial and industrial installations. The successful candidate will be required to conduct correspondence and negotiations with consumers.

Applications, naming two referees, to S. J. C. Ellis, A.I.E.E., Joint District Manager, SEEBOARD, 65, Mortimer Street, Herne Bay, Kent, by 1st January, 1958.

A. L. BURNELL,
Secretary. 1710

NEWCASTLE CORPORATION TRANSPORT AND ELECTRICITY UNDERTAKING

APPLICATIONS are invited for the position of SUBSTATION ATTENDANT from persons having experience in the operation of rotary converter substation supplying a traction undertaking.

The appointment will be in accordance with the N.J.I.C. for the Electricity Supply Industry. Present wages 4s. 5¾d. per hour.

Applications, stating age, qualifications and experience, together with copies of two recent testimonials, should be forwarded so as to reach the undersigned not later than first post on Saturday, 18th January, 1958.

F. S. TAYLOR, M.Inst.T.,
Manors, General Manager.
Newcastle upon Tyne, 1. 1690

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Second Assistant District Engineer, Uddingston District

APPLICATIONS are invited for the above appointment. Applicants should possess the necessary technical qualifications and should have had a sound engineering training with subsequent experience in the operation and maintenance of H.V. and L.V. underground and overhead distribution systems and with H.V. fault location. They should also be conversant with load flow diagrams and voltage drop calculations.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A. The present classification and grading is F.7, salary £885/£930 per annum. This post is superannuable, subject to satisfactory evidence of health. The successful candidate will require to reside within a reasonable distance of the District Offices at Uddingston, and to take part in standby duty in accordance with the above Agreement.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

DUGALD SMITH,
137, Alma Street, Manager.
Hamilton. 1691

WIRING IN PRODUCTION

ENGLISH ELECTRIC

STAFFORD

WE wish to appoint an engineer who has specialised in light current production wiring and termination techniques.

The successful applicant will work in an advisory capacity. He will be intimately concerned with the design for manufacture, selection of materials and method of production wherever improved wiring techniques can be usefully introduced. This is a responsible opening which should attract engineers capable of introducing a fresh approach to new work.

Applications will be welcomed from engineers whose experience derives from fields other than power technology.

Please write giving full details of age, experience and qualifications to—

Central Personnel Services,
Marconi House,
336/7, Strand, London, W.C.2,
quoting Ref. ER.1201C.

1671

TECHNICAL INSTRUCTOR (ELECTRICIAN)

required by GOVERNMENT OF NORTHERN REGION, NIGERIA, for two tours of 18/24 months or three tours of 10/12 months. Option of appointment either (a) on agreement with prospect of permanent and pensionable employment in salary scale (including inducement addition) £750 rising to £1,284 a year, or (b) on contract in salary scale (including inducement addition) £810 rising to £1,386 a year, with resettlement grant at rate of £100/£150 a year. Clothing allowance £45. Free passages for officer and wife. Assistance towards cost of children's passages and grant up to £288 annually. Liberal leave on full salary.

Candidates must have served full apprenticeship and possess C. and G. Certificate. They must be practical tradesmen with experience of domestic installation work and the installation and maintenance of generating units. Apprenticeship training or other teaching experience desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/41933/EF. 1677

CONTRACTS ENGINEERS

A. REYROLLE & COMPANY LTD., of Hebburn, County Durham, who are the largest firm of switchgear specialists in the world, have vacancies for CONTRACTS ENGINEERS both for home and overseas contract work on E.H.V. switchgear. In addition, vacancies also exist for CONTRACTS ENGINEERS to handle work in connection with major industrial installations and medium-voltage switchgear.

The appointment would be for work at Hebburn, and it is customary for the company to appoint engineers for duties in the overseas and home area offices from engineers trained at Hebburn.

The work requires initiative and affords the engineer individual responsibility. It is interesting and varied and calls for ability to conduct both technical and commercial negotiations. The desirable qualifications are therefore a Degree or a Higher National Diploma or Higher National Certificate, but candidates having Ordinary National Certificate who are still proceeding with studies could be considered specially. Applicants need not have specialised previously in switchgear, and if necessary suitable introductory training would be arranged.

Applications, giving full particulars of technical training and previous experience, should be forwarded to the Contracts Manager, A. Reyrolle & Co. Ltd., Hebburn, Co. Durham, marked "Personal." 1448

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (Operation), BARKING "C" POWER STATION (Vacancy No. 57/1137).

Successful applicant will be required to carry out, under the Operation and Efficiency Engineer, investigations into plant performance, assist in statistical work, collect information for various returns, assist in drawing up new operating routines, compile operation sketches and information, and generally assist the Operation and Efficiency Engineer. Salary Class J, Grade 11 = £885 p.a.

ASSISTANT SHIFT CHARGE ENGINEER, STEPNEY POWER STATION (Vacancy No. 57/1138).

Sound engineering and technical training with experience of pulverised fuel firing an advantage. Salary Class F, Grade 9 = £830 plus £79 shift p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Authority, London Division, P.O. Box 136, London, W.1, by 30th December, 1957. 1686

ELECTRICAL AND ELECTRONIC ENGINEERS

HILGER AND WATTS LTD. invite applications from suitably qualified Graduate Engineers willing to assist in the development of high-voltage sparking equipment to be used in the automatic analysis of metals. The successful applicant will need to have a sound knowledge of the techniques of high-voltage and electronic design and the ability to negotiate successfully with sub-contractors.

The post offers the opportunity of a progressive career with an expanding company of international reputation.

Five-day week, canteen facilities, superannuation scheme.

Those interested should write in the first instance stating age and giving full details of education, qualifications and experience, quoting Ref. B.13, to the Personnel Officer, 98, St. Pancras Way, Camden Road, London, N.W.1.

1716

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post :—

GENERAL ASSISTANT ENGINEER, BRIMSDOWN GENERATING STATION.

Salary Class K, within the range of Grades 16/14, £635 × £15 to £785 per annum plus London weighting, plus 10% shift allowance when required to work on shift.

Duties include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station, and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of the Ordinary National Certificate or its equivalent will be an advantage.

Applications, quoting reference No. 2/8723, stating age, qualifications and experience, should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 31st December, 1957.

W. N. C. CLINCH,
Controller. 1702

CENTRAL ELECTRICITY AUTHORITY

Assistant Mechanical Engineers

Bradwell (Essex) and Berkeley (Glos) Nuclear Power Stations

ASSISTANT MECHANICAL ENGINEERS required to assist the site mechanical engineers at the above power stations in the inspection of fabrication and installation of mechanical engineering plant, both conventional and nuclear. Candidates should have qualifications up to H.N.C. or equivalent standard or an Engineering Degree. They should have some works experience or apprenticeship training.

These are permanent appointments and successful candidates would be expected to live in the vicinity of the site to which they are allocated for the duration of the constructional work which will be approximately a two-year period. Opportunities will be available for transfer to future nuclear power station sites and to the design teams associated with these stations.

Salaries for the appointments will be within scales £820-£995 p.a. or £1,055-£1,265 p.a.

Applications stating age, qualifications, experience, present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 15th January, 1958. Quote ref. ER/515. 1722

TECHNICIANS

required by

THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKSHIRE,

to be responsible for inspection, testing to specification, fault-finding and calibration of a wide range of electronic equipment such as high-speed oscilloscopes and associated units, pulse generators, video amplifiers, E.H.T. units, calibrators, etc.

Equipments involved are in small quantities of widely varying design and are dealt with in small batches ; occasional attendance at A.W.R.E. outstations and contractors' works will be required.

A recognised engineering apprenticeship and several years' approved practical training and experience on electronic testing and fault finding required. Possession of technical qualifications to at least O.N.C. level an advantage.

Salary £755 (at age 28 or over) to £875 per annum.

Contributory superannuation scheme. A house or assistance towards legal expenses on house purchase will be available for married officers living beyond daily travelling distance.

POSTCARD for application forms to the Senior Recruitment Officer at above address. Please quote ref. 1657/48. 1678

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Appointment of Secretary, No. 2 Sub-Area

APPLICATIONS are invited for the above appointment at the Board's No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire.

Duties will include establishments and personnel matters, labour relations, the acquisition of property and wayleaves and general administration, and candidates should have had extensive experience in this field, either in the electricity supply industry or a similar industry. They should preferably possess a recognised secretarial or other suitable qualification. Experience in the administration of superannuation schemes and the handling of common law claims for damage and insurance will be an additional advantage.

The salary will be within the range £1,900/£2,100 per annum.

The appointment is superannuable and subject to medical examination.

Applications should be submitted to the Establishments Officer, at Board Headquarters, Electricity House, Love Lane, Liverpool, 3. Closing date 7th January, 1958. 1703

ENGLISH ELECTRIC

OFFERS CAREERS TO YOUNG MEN HAVING AT LEAST O.N.C. (ELECTRICAL) AND PRACTICAL EXPERIENCE.

A Training Course is being arranged on the company's heavier range of Switchgear.

On satisfactory completion, appointments will be made to the Applications Section or to the Circuit Breaker Design and Development Section of the Switchgear Engineering Department, Stafford. The former department is actively engaged in the engineering of switchgear schemes relating to a variety of generation and utilisation projects, while the latter is engaged on long-term development of circuit breaking equipment.

Generous salaries will be paid during training. Help will be given with removal expenses and accommodation.

All applications will be treated confidentially.

Write giving full details to Central Personnel Services, 336/7, Strand, London, W.C.2, quoting Ref. ER.1201B.

356

DRAUGHTSMEN AND DESIGNER-DRAUGHTSMEN

are required by the

BRUSH ELECTRICAL ENGINEERING CO. LTD., LOUGHBOROUGH,

in their expanding Switchgear Division.

Vacancies exist at their Loughborough works and also at their Manchester design office. Applicants should have had previous experience in a drawing office, and preference will be given to those with a knowledge of switchgear. There is considerable scope for advancement.

A good salary will be paid and conditions of service include a non-contributory superannuation scheme.

Applications giving particulars of past experience and qualifications should be addressed to the Chief Personnel Officer, Brush Electrical Engineering Co. Ltd., Loughborough, Leics., and should quote reference SD.7315.

1684

LONDON TRANSFORMER DRAWING OFFICE

'ENGLISH ELECTRIC'

GOOD TRANSFORMER DRAUGHTSMEN as well as MECHANICAL DRAUGHTSMEN

are required for work on the heavier range of transformer manufactured by the company (30 MVA - 350 MVA).

These are permanent staff appointments carrying excellent salaries and offering opportunity for advancement within the Group to men who wish to progress.

This new office is pleasantly appointed in a modern office block 5 minutes from Victoria Station.

There are also attractive openings for JUNIOR DRAUGHTSMEN in this office.

We would also like to hear from Senior and Junior Draughtsmen interested in similar work at our STAFFORD works.

Please write giving full details to Central Personnel Services, 336/7, Strand, London, W.C.2, quoting Ref. ER.1299C.

1521

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Appointment of Second Assistant Engineer, Technical Department (Protective Gear and Electrical Plant Testing)

APPLICATIONS are invited for the above appointment with headquarters at Newcastle upon Tyne.

Applicants should have had experience in the commissioning and maintenance of protective gear and the testing of large electrical plant.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Grade 4 (£1,145-£1,375) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 2nd January, 1958. 1687

ELECTRONIC ENGINEER

required in the ELECTRICAL DEPARTMENT of THE STEEL COMPANY OF WALES Ltd. (Steel Division).

The successful candidate will be responsible for the development and maintenance of electronic equipment for general steelworks applications. A considerable degree of initiative is required and the ability to work closely with manufacturers on new applications. The successful maintenance of the equipment is of vital importance.

Applicants should possess a University Degree or equivalent in Electrical Engineering, preferably with Electronics as a subject in the final year. Previous practical experience in manufacturing or development work desirable.

Those wishing to apply should write giving fullest possible details of age, experience, qualifications and present salary, quoting the reference 303/ER. to:—

Superintendent, Personnel Services
THE STEEL COMPANY OF WALES LTD.
Abbey Works, Port Talbot, Glam. 1719

WIGAN AND DISTRICT MINING AND TECHNICAL COLLEGE

APPLICATIONS are invited for a post as LECTURER IN ELECTRICAL ENGINEERING. Duties will commence as soon as possible.

Candidates should hold a good degree and/or equivalent professional qualification, and should be able to teach Electrical Engineering up to final degree and diploma standard. Experience of electrical engineering in the mining industry might be an advantage. Salary in accordance with the Burnham Technical Scale for Lecturers (£1,200-£30-£1,350).

Further particulars and application form will be sent by the undersigned. Last date for receipt of applications, Saturday, 4th January, 1958.

E. C. SMITH, Principal.
9th December, 1957. 1713

SOUTHERN ELECTRICITY BOARD

Demonstrator

EALING District of No. 1 (Southall) Sub-Area. Salary N.J.C. Grade 1 (£500-£600 per annum plus £40 London weighting). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus, and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualification would be an advantage.

The successful candidate will be required to contribute to the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, in envelopes suitably endorsed, not later than 30th December, 1957. 1676

SOUTHERN RHODESIA ELECTRICITY SUPPLY COMMISSION

Central Workshops, Salisbury

TRANSFORMER REWINDER required. Salary scale £1,050 to £1,200 gross per annum.

Applicants should be completely conversant with all stages of assembly of large power transformers including O.L.T.C. units and should have a thorough knowledge of rewinding and repairs to all types and sizes of transformers, particularly large units.

Preference will be given to applicants having had a period of service with a large transformer manufacturer.

Subject to the signing of a contract for three years' service, passages to Rhodesia will be paid.

Application forms may be obtained from the Secretary (R), Rhodesia House, 429, Strand, London, W.C.2, and completed application forms should be forwarded by air mail to the Secretary, P.O. Box 377, Salisbury, Southern Rhodesia by 18th January. 1720

TECHNICAL INSTRUCTOR (ELECTRICAL)

required by FEDERAL GOVERNMENT OF NIGERIA EDUCATION DEPARTMENT for appointment on contract for two tours of 18/24 months or three tours of 10/12 months. Salary according to age, qualifications and experience in scale (including inducement addition) £834 rising to £1,386 a year. Resettlement grant at rate of £100/£150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in United Kingdom. Liberal leave on full salary.

Candidates must have served full apprenticeship and possess C. and G. Certificate. They must be experienced practical tradesmen, and should preferably have experience of apprenticeship training.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/42493/EF. 1695

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's Eastern District at Stratford, London, E.15.

Applicants should have had a sound technical education up to at least Higher National Certificate standard, preferably being Corporate Members of the I.E.E., and possess a practical experience of all branches of engineering work associated with the organisation of a District distribution department, particularly in regard to mains and substation work.

The post is graded under Schedule "A" of the National Joint Board Agreement as Class J, Grade 12, £830 per annum, rising to £885 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 4th January, 1958. Please quote ref. PER/2367/R. 1689

CLASSIFIED ADVERTISEMENTS ARE PREPAID

MIDDLESEX COUNTY COUNCIL

ASSISTANT ELECTRICAL ENGINEER required in County Engineer's Dept., Entertainments Licensing Section, at Hendon Central. A.P.T. II (£696 rising to £725 p.a. at 1/4/58 and then to £845 p.a. plus London weighting according to age). Established, pensionable, subject to medical assessment Prescribed conditions. Should be over 25 years, have received good general education, and preferably hold Higher National Certificate in Electrical Engineering, or equivalent examination. Experience of electrical installation work of large buildings essential. Required to carry out certain inspection duties outside office hours, for which additional £110 p.a. paid. Motor car required, allowance considered.

Apply to County Engineer, 10, Great George Street, London, S.W.1, by 28th December, 1957 (quote W.573ER). Canvassing disqualifies. 1598

ELECTRIC MOTOR SALES

REPRESENTATIVES required by outstandingly progressive company for sales of motors from fractional to 600 h.p.

Best possible prospects, incentives and conditions for top grade men.

Applications to:—

The Managing Director,
NEWMAN INDUSTRIES LIMITED,
Yate, Bristol.

1568

SALES ENGINEER

A LEADING electrical manufacturing company requires the services of a SALES ENGINEER in its London office. Candidates should be between 30 and 40 years of age, Corporate Members of the I.E.E., and have experience of selling to industrial plant users. Knowledge of the steel industry would be an advantage. Salary in range £1,400/£1,800 p.a. Write to Box ER.793, c/o 191, Gresham House, London, E.C.2. 1714

BARROW IRONWORKS LIMITED

Barrow-in-Furness

ASSISTANT ELECTRICAL ENGINEER required with sound technical training and practical experience on maintenance, installation, generation and control equipments up to 6,600 v. A.C. On heavy plant as associated with blast furnaces.

The post is superannuable.

Reply, giving full details of education, training, etc., to Managing Director, Barrow Ironworks Limited, Barrow-in-Furness. 1567

REPRESENTATIVE

(age 25/30 years)

for S.W. OF ENGLAND, BRISTOL AND DISTRICT

required by old-established E.W.F. wholesale distributors. Good prospects. Salary, expenses and commission. Pension scheme. Car provided or car allowance in lieu.

Write in confidence, stating age and experience to the Manager, Sloan Electrical Co. Ltd., 2, John Street, Bristol, 1. 9220

SURREY COUNTY COUNCIL

APPLICATIONS invited for the appointment of PRINCIPAL ASSISTANT ELECTRICAL ENGINEER GRADE "A," £1,105 × £45/£35 to £1,320 per annum. A.M.I.E.E. with experience in (a) supervision of technical staff, (b) design and installation of electrical services.

Full details, present salary and three copy testimonials to County Architect, County Hall, Kingston-on-Thames, as soon as possible. 326

APPLICATIONS are invited for position of technical assistant contract engineer with large electric cable contracting company. Applicants should have minimum qualification of O.N.C. in Electrical Engineering. Duties comprise compiling detailed schemes for electrical transmission and distribution. Ample scope for promotion. Pension fund and other privileges.—Box 1523.

CIRCUIT and layout draughtsman required for automatic control gear associated with multi-motored machine tools. Knowledge of the application of transductors and electronic equipment desirable. A.S.D.E. rates of pay; bonus; five-day week; canteen facilities. Apply in first instance in writing to The Newall Engineering Co. Ltd., Peterborough, giving full details of past experience and particulars of any qualifications held. 1612

CIRCUIT design draughtsmen required by company manufacturing industrial control equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 273

CONSULTING engineers require junior electrical draughtsman/engineer for lighting and power installations in offices, colleges, hospitals, etc. Five-day week, bonus. Apply Harding, McDermott & Partners, 17, Doughty Street, London, W.C.1. 331

DESIGN draughtsman experienced electro-mechanical devices and preferably on-load voltage regulation. Permanent pensionable post. New house available to rent. South of England. Company expects to pay not less than £800 p.a. Reply in confidence "Chief Draughtsman."—Box 1693.

DEWHURST & PARTNER Ltd. require technical estimator for preparing tenders in their estimating engineering department. Applicant must have good electrical engineering background and have basic knowledge of motor control equipment and its applications. The position is a senior one, and housing assistance will be given to successful applicant if necessary. Canteen facilities, pension scheme. Write giving age, experience, etc., to — Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middlesex. 274

DRAUGHTSMAN: H. J. Heinz Company Limited have a vacancy for a draughtsman for electrical services. Applicants should be aged 25/40, with a minimum of 5 years' drawing office experience, and be familiar with all aspects of main and subsidiary electrical services, and should preferably be of H.N.C. standard. The company operates a non-contributory pension scheme and excellent sporting facilities are available. Please apply to—The Personnel Officer at Harlesden, London, N.W.10. 1715

DRAUGHTSMAN wanted, electrical experience an advantage. Opportunity for ambitious man in Westminster office. Write age, experience and salary required.—Box 1672.

ELECTRICAL contracting firm in Edinburgh, of good standing, has vacancy for a technical assistant. Excellent progressive post for qualified electrical installation engineer, who should preferably be between the age of 25-35 and have qualification comparable to Higher National standard. Salary £750-£1,250 per annum, with pension scheme and allowances. Apply giving full particulars of qualifications and experience in confidence to—Box 1663.

ELECTRICAL engineering assistant required with experience in preparing specifications for new electrical installations in buildings. Salary up to £860 per annum according to qualifications and experience. Pensionable. Application form from Chief Engineer (57/83), London County Council, County Hall, London, S.E.1. (2269) 1679

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ESTIMATING. E. K. Cole Limited, Malmesbury, Wilts., have a vacancy for an estimator. The company is engaged on electronic equipment and applicants should have had a wide experience in estimating this class of work and small quantity production. Good practical shop training is considered essential and an engineering apprenticeship desirable. Good salary will be offered and there is a possibility of housing accommodation being available to suitable applicants. Full welfare facilities and contributory pension scheme. Please apply in writing with details of education, training and experience, to the Personnel Manager. 228

Situations Vacant (continued)

INSPECTOR for electrical work with experience of lifts required. Rate 275s. a week. Application form from Chief Engineer (57/85) L.C.C., County Hall, London, S.E.1 (2302). 1723

JUNIOR electrical engineer/draughtsman. Age 22/25, H.N.C. or O.N.C., experienced in estimating and contract work for mechanical handling plant. Pension fund. Sports and canteen facilities. Particulars of experience, qualifications and salary to—W. J. Jenkins & Co. Ltd., Retford, Notts. 1501

LAMP factories in London have vacancies for technicians working with incandescent lamps and filaments. Applicants must be over 18 years of age with suitable experience or able to undertake further training. Apply, quoting ref. LED/WJM, to—Atlas Lighting Ltd., Angel Factory Colony Estate, Edmonton, London, N.18. 1550

LEADING London firm heating, ventilating and air conditioning engineering contractors require electrical engineer experienced in circuit design and automatic controls. Age 25/30 years preferred. Write—Box 759, Sells Ltd., Brettenham House, Strand, London, W.C.2. 1615

LONDON consulting engineers require electrical engineers for installation design for hospitals, commercial buildings, schools, etc. Write stating age, qualifications, experience and salary required to—Box 160.

PLANT superintendent with suitable electrical qualifications required for furniture factory. Good conditions and salary. Apply—Works Manager, Dancer & Hearne Bros. Ltd., Penn Street, Nr. Amersham (Tel. Holmer Green 3154). 1673

PRODUCTION engineer wanted for small electrical control gear works, Taunton, Somerset. State experience and salary required. —Box 353.

PROVINCIAL engineering firm requires senior estimator/supervisor for electrical contracting department. Office trained, with practical experience. Write age, experience, references.—Box 9219.

TESTER of automatic electric control equipment required. Interesting work with good prospects. O.N.C. standard preferred. Five-day week, pension scheme, canteen facilities. Please write giving full details of age, previous experience, qualifications, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 277

THE RHEOSTATIC Company Limited, Slough, Bucks., require electrical engineer, age 25/30, with Higher National Certificate and experience with temperature controls or similar equipment, for vacancy in home sales department, Slough. Applications, stating education, experience and salary to — Home Sales Manager. 1717

TRANSFORMER draughtsmen, senior and junior, for all types up to 500 kVA. Good salary and housing assistance if needed for the right men.—Transformers & Rectifiers Ltd., Millmead, Guildford. 1694

TRANSFORMER engineer required to control design and drawing office handling transformers of all types up to 250 kVA. Applicant must be fully experienced in the design of transformers in this range and a knowledge of costing would be an advantage. Salary £900 per annum. Apply — Willesden Transformer Company Limited, Manor Park Works, Manor Park Road, Harlesden, London, N.W.10. 311

VACANCIES occur for skilled plumber-jointers with experience in jointing all types of cables, preferably up to and including 11 kV. These vacancies arise from extensive contract works in the Home Counties. Good working conditions and London rates of pay.—Box 1680.

WHOLESALERS require invoice/pricing clerk. Good salary and prospects. Tel. PAD. 1442 or write A. J. Wright Ltd., 95, Lisson Grove, London, N.W.1. 9221

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ELECTRICAL contractor's London manager (35) seeks change, managerial or executive post with reputable company. Available February or March. All enquiries answered. Please reply—Box 9215.

ARTICLES FOR SALE

T. W. W.

Capstan and Turret Lathes

HERBERT No. 4 Senior Motor-driven Capstan Lathe, for chuck work, hole in spindle 2-1/16"; 8 speeds, 40-1,000 r.p.m.
HERBERT No. 4BS Motor-driven Capstan Lathe, for bar work, 8 spindle speeds, 30-511 r.p.m.
HERBERT No. 4 Motor-driven Capstan Lathe, for chuck work, 8 spindle speeds, 45-767 r.p.m.
Two BENRATH Motor-driven Capstan Lathes, 5½" centres, for bar work, collet capacity 1¼", 6 spindle speeds, 60-1,120 r.p.m.
HERBERT No. 2B Motor-driven Capstan Lathe, 5½" centres, 6 spindle speeds, 48-1,017 r.p.m.
HERBERT No. 7 Motor-driven Combination Turret Lathe, 8" centres, 2¾" hollow spindle, 8 spindle speeds, 18-366 r.p.m.

Slotting Machines

MOREY 12" stroke Motor-driven Slotting Machine, 24" table, power feeds with R.P.T., angular adjustment of ram.
G.S.P. 10" stroke Motor-driven Slotting Machine, swivelling head, 19¼" table with power feeds.

Shaping Machines

Two G.S.P. 31½" stroke Motor-driven Heavy Duty Shaping Machines, table 31½" × 15¾" × 17¾", with power feeds. Machine vice.
New INVICTA MAJOR 30" stroke Motor-driven High-speed Shaping Machine.
New INVICTA Model 6M, 24" stroke Motor-driven Shaping Machine.
Secondhand INVICTA Model 6M, 24" stroke Motor-driven Shaping Machine.
Secondhand HERBERT 20" stroke Type ND Motor-driven Shaping Machine.
New ALBA Model 4S, 18" stroke Motor-driven Shaping Machine.
Secondhand NEWEY 14" stroke Motor-driven Shaping Machine.

THOS. W. WARD LIMITED
Brettenham House, London, W.C.2
(TEMple Bar 1515, 12 lines) 1697

G. F. WALKER & SON
offer

50 SIMPLEX B.E. Watertight Switches	£8
60 doz. SIMPLEX 1¼" Galv. Lock-nuts	£10
50 doz. SIMPLEX 1¾" B.E. Lock-nuts	£7
24 gr. WALSALL 1¼" Brass Ring Bushes	£60
88 doz. Round Conduit Boxes, galv., ⅜", 4-way	£60
42 doz. G.E.C. ⅜" B.E. Through Boxes	£20
24 gr. G.E.C. 2" Galv. Crampets	£20
45 doz. G.E.C. ⅜" B.E. Back Plates	£11

60, June Avenue, Leicester
(Phone: Syston 3198) 1681

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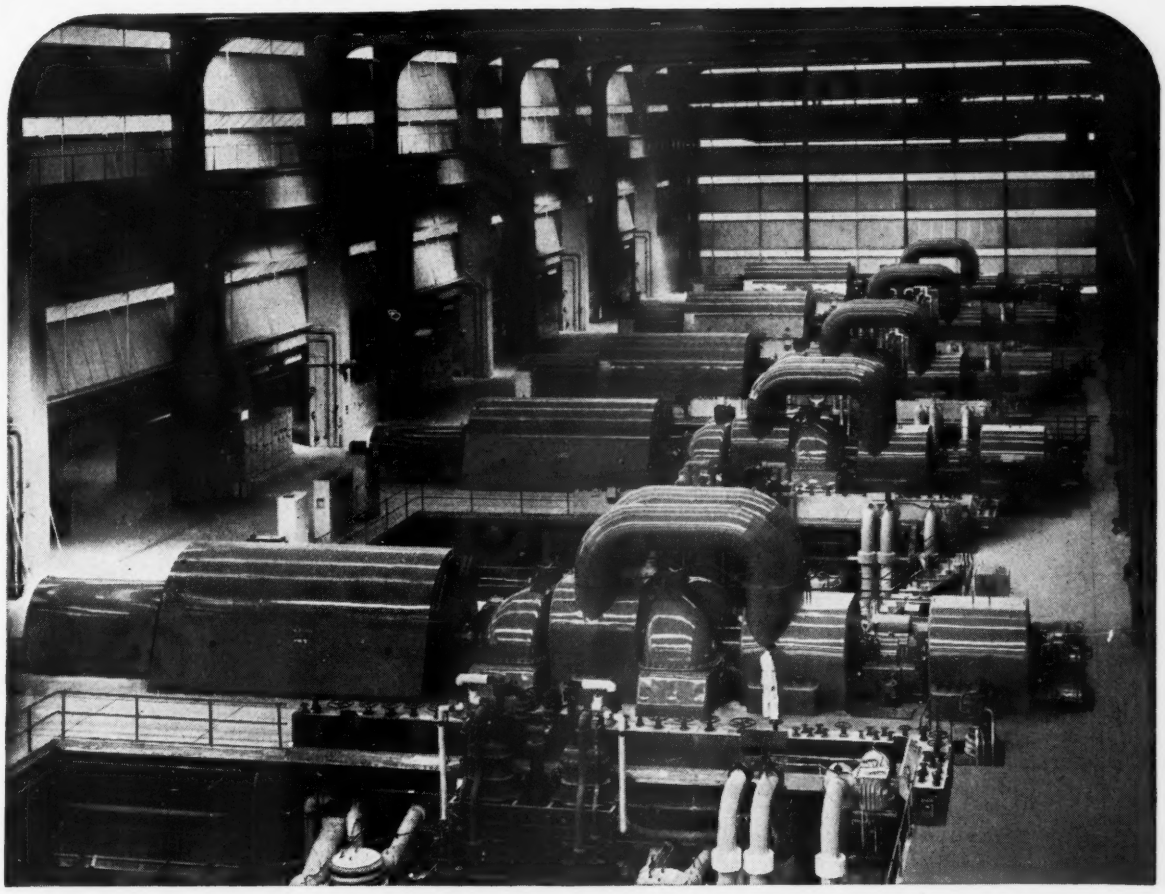

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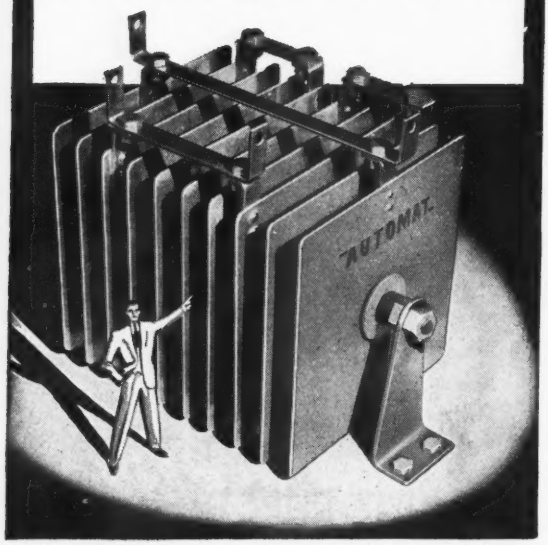

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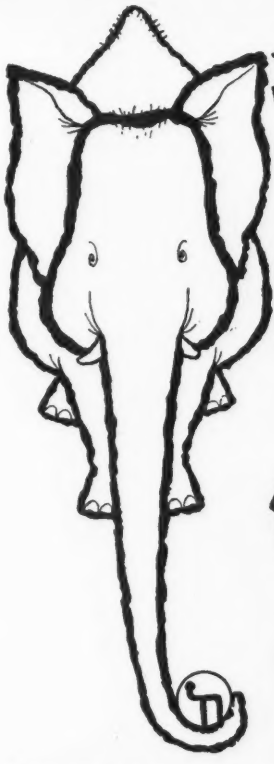

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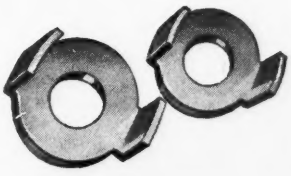

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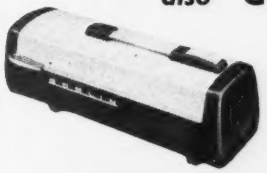

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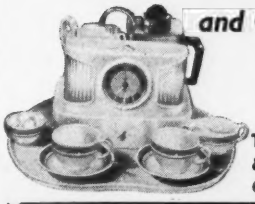

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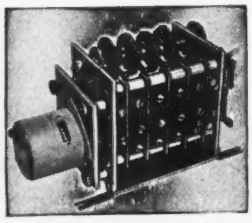

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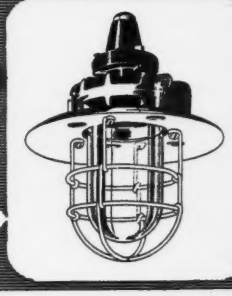

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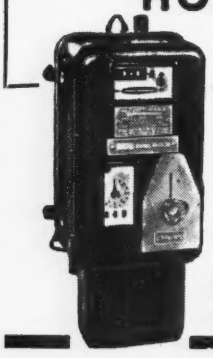

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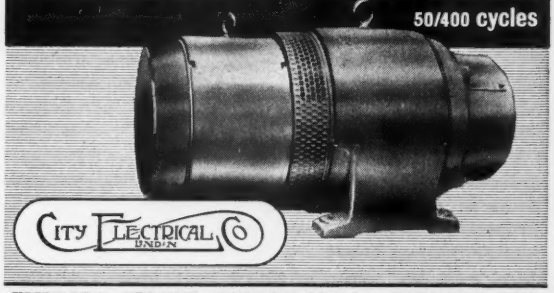

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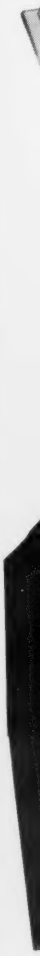

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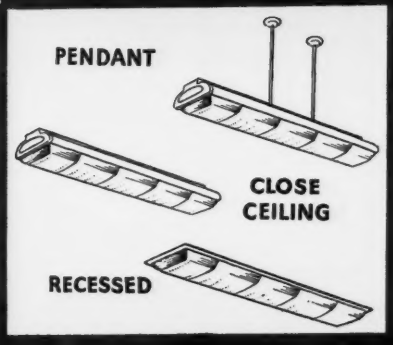

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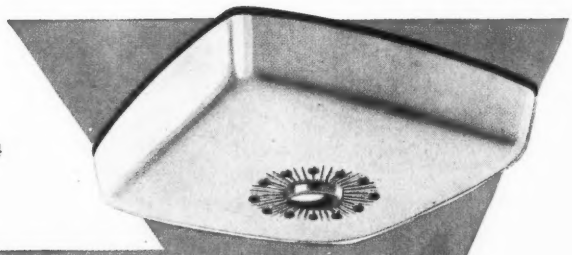

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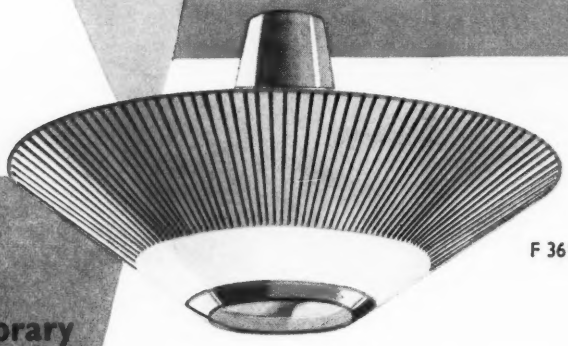

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